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MAINTENANCE TRAINING EQUIPMENT: DESIGN SPECIFICATION BASED ON INSTRUCTIONAL SYSTEM DEVELOPMENT

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This technical paper presents a model for documenting training equipment designs derived from an Instructional System Development (ISD) analysis. The model, presented in a handbook type format, contains blanks to be completed by the ISD analyst(s). Since the model is appropriate for documenting various kinds of possible designs, the model is accompanied by an appendix which provides instructions for applying the model. The model provides a method for communicating a specific training equipment design to the procurement office after the ISD analysis has established a need for a maintenance trainer. The model has been specifically organized and formatted such that it can be easily used by procurement office personnel to prepare the procurement specification that eventually goes to contractors for bids.

The model provides the ISD analysts an opportunity to specify such design information as (a) characteristics of the target population who will use the trainer, (b) a list of the training objectives to be achieved using the trainer, (c) a list of the tasks to be practiced and/or acquired on the trainer and a list of the malfunctions to be presented by the trainer for isolation and/or correction, (d) a scenario discussing how the

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trainer will be used to achieve the specified training objectives; (e) a list of ~~the~~ physical and functional characteristics of the components to be represented on the trainer; and (f) a description of ~~the~~ instructional features required on the trainer to facilitate training objective achievement.

When utilized, the model will improve, standardize, and facilitate the communication between ISD and procurement personnel.

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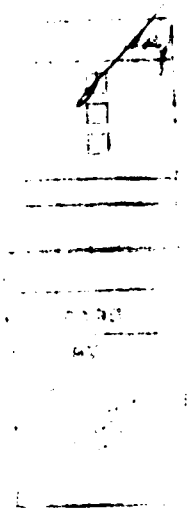

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SUMMARY

Instructional Systems Development (ISD) analysts have had much difficulty communicating their training device requirements to procurement personnel (when it has been determined that a maintenance simulator is needed). Such ineffective communications have resulted in the procurement of ineffective training devices. An ISD-based model training requirements specification was developed in military specification format to facilitate the development of procurement specifications. An accompanying handbook was developed to provide direction and additional information for completing the model specification. The model training requirements specification makes it easier for procurement personnel to interpret ISD derived training requirements, in order to develop a detailed Prime Item Development Specification for the acquisition of appropriate and effective training devices.

PREFACE

This document is a revised and updated edition of the report, Maintenance Training Simulator Design and Acquisition: ISD-Derived Training Equipment Design (AFHRL-TP-81-52). This document was produced under a modification to the original contract list below. Mr. Robert J. Carroll is the Project Director. Captain Randy H. Massey is the Air Force Contract Monitor.

The original document was prepared by Applied Science Associates, Inc. (ASA), Valencia, Pennsylvania, under Air Force Contract No. F33615-78-C-0019. Mr. George R. Purifoy, Jr. was the Principal Investigator and Project Director. The sponsor was the Technical Training Branch (at Lowry Air Force Base, Colorado) of the Logistics and Technical Training Division of the Air Force Human Resources Laboratory. Dr. Edgar A. Smith was the Contract Monitor.

This study is one of a series of related studies under Project 2361, Simulation for Maintenance Training. Project 2361 is an advanced development program to develop, demonstrate, test, and evaluate selected applications of computer-based simulation for Air Force maintenance training. The objective of this program is to build baseline knowledges about techniques, procedures, and principles necessary for broad application of simulation in maintenance training. Simulator training devices are being fabricated and demonstrated in an operational training environment in order to establish cost, reliability, and training effectiveness information. These data will contribute to a determination of training value factors for eventual Air Force use. Demonstration of the training/cost-effectiveness of simulation techniques, coupled with analyses of effective simulation management tools, will provide the necessary empirical data to design user handbooks, and to prepare life cycle management guides for the effective utilization of simulation in maintenance training.

This report contains a model for documenting a training equipment design. The model, in the form of a military specification, is to be completed by the Instructional System Development (ISD) analyst(s) when the need for a maintenance trainer has been identified. The model provides a method by which a training equipment design can be communicated to the System Project Office (SPO) Training Equipment Acquisition Manager. Included as part of this model is an appendix which provides instructions for applying the model in specific situations.

The authors wish to acknowledge the assistance and cooperation of the many individuals who contributed information and critiques ideas. From ASA: Dr. Hobart Harris, Ms. Jennifer Smith, Mr. Vernon Hanson, Dr. J. Thomas Roth, Ms. Lisa Thocher, and Ms. Jean Fitzpatrick. From the Air Force:

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SECTION I

INTRODUCTION

This paper presents a model for documenting maintenance training simulator designs and instructions to tailor the model to specific applications. Included in this paper are a number of updates to the previous version (Hritz & Purifoy, 1982).[1] These updates reflect the addition of new lessons learned in simulator specification development, new requirements, and the collection of empirical data on the utilization, effectiveness, and acceptance of maintenance training simulators. The user of this model is encouraged to consult a related report (Carroll, Thocher, Roth, & Massey, 1984)[2] to obtain a detailed view of the utilization and characteristics of maintenance simulators.

The model, presented in handbook type format, is designed to serve as a vehicle for communication between Instructional Systems Development (ISD) analysts and procurement officers. Use of the model is to ensure that the desired characteristics of the trainer are fully and accurately communicated to both the procurement officer and the ultimate development contractor for the simulator. Simulator characteristics addressed by the model include the intended capabilities of the trainer, how the trainer is to be utilized by students to attain training objectives, the required degrees of trainer fidelity, and the types of instructional features that are to be included in the trainer.

The model for documenting training equipment design decisions is intended to be completed by ISD analysts once the need for a maintenance trainer has been identified through the ISD process. The model is presented in military specification format to help ensure ease of development of procurement specifications and consistency between different documented designs. A completed application of this model will effectively communicate the characteristics of an ISD-based

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[1] Hritz, R. J. & Purifoy, G. R., Jr. Maintenance training simulator design and acquisition: ISD-derived training equipment design. AFHRL-TP-81-52, AD-A110871. Lowry AFB, CO: Logistics and Technical Training Division, Air Force Human Resources Laboratory, February 1982.

[2] Carroll, R. J., Thocher, L. I., Roth, J. T., & Massey, R. Maintenance training simulators: Their use, cost, and training effectiveness. Valencia, PA: Applied Science Associates, Inc., September 1984.

maintenance training equipment design to the procurement office. This office, in turn, translates the requirements reflected in the ISD-based design into a procurement specification for the device, utilizing a generic Prime Item Development Specification document (Hritz, Purifoy, & Fitzpatrick, 1981).[3]

The model for documenting a specific training equipment design has the following characteristics:

1. The model contains blanks to be completed by the ISD analyst. The blanks permit the requirements to be stated in a manner convenient to the ISD analyst. The appendix accompanying the model provides instructions on what content is to be inserted in the blanks. Often the appendix contains suggested wording that is appropriate for completing the blanks.

2. Most of the paragraphs and/or subparagraphs to be included in the specific application of the model are selected by the ISD analyst. That is, specific paragraphs or subparagraphs can be deleted or retained, depending on the specific application. However, it is suggested that if a particular paragraph or subparagraph is desired to be deleted, the ISD analyst should include the paragraph or subparagraph heading and in the blanks insert "not applicable." In this way, the procurement officer will know that the particular paragraph or subparagraph was purposefully deleted (rather than merely forgotten).

3. Application of the model in a specific situation is independent of any ISD procedure used to determine the training equipment design requirements. That is, the completion of the model is not predicated on any special or unique ISD procedure. The model represents the information or design requirements that must be or should be communicated to the procurement office regardless of how that information or those requirements were determined. However, it should be pointed out that decision-making procedures leading to all the design requirements indicated

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[3]Hritz, R. J., Purifoy, G. R., Jr., & Fitzpatrick, J. A. Prime item development specification for maintenance training simulators-model specification and handbook. AFHRL-TP-84-44(I,II). Lowry AFB, CO: Training Systems Division, Air Force Human Resources Laboratory, 1984.

in the model are spelled out in a document titled Maintenance Training Simulator Design and Acquisition - Handbook of ISD Procedures for Design and Documentation.[4] The decision-making procedures specified in that Handbook or in any other ISD procedural handbook (e.g., 3306th Procedural Handbook) can be used to derive the training equipment design, while the model can be used to document the training equipment design resulting from the applied procedures. If Maintenance Training Simulator Design and Acquisition - Handbook of ISD Procedures for Design and Documentation is used, then the completion of the model for a specific application can be facilitated because many of the forms being completed in that procedure can be directly inserted into the model.

4. It allows the ISD analyst to enter only what is known at the time of completing the specific application of the model. For example, if all the training objectives are not known at the time of submitting the completed design, the analyst should list all the objectives that are known and indicate that "the list provided herein is only a partial list and is not meant to be exhaustive." The same rationale and approach apply to entire paragraphs and/or subparagraphs of the model. For example, if the environmental characteristics to be simulated are not yet known, the analyst can either:

    a. Insert in the blanks "to be determined" or

    b. Enter the expected environmental characteristics to be simulated and state that "The above characteristics should not be taken as absolute and only represent a determination based on the data available at the time of completion."

5. Although the model is organized in a purposeful manner, there is no priority or order implied in completing the specified paragraphs and/or subparagraphs. That is, the ISD analyst(s) should feel free in supplying the information requested in any order deemed appropriate; e.g., paragraph 3.0 can be completed before paragraph 2.0.

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[4] Hritz, R. J., & Purifoy, G. R., Jr. Maintenance training simulator design and acquisition - Handbook of ISD procedures for design and documentation. AFHRL-TR-81-51 Lowry AFB, CO: Logistics and Technical Training Division, Air Force Human Resources Laboratory, February 1982.

6. Because of the limitations of the available data base, the preparer of a specific application of the model might find it useful to state in paragraph 1.0 that "The information and requirements specified herein are limited by the availability of the data base and time restrictions, and as such, the specified design should not be considered absolute and only represents the design features which could be determined from the available data."

7. The design of the model recognizes the iterative nature of an ISD analysis and the time constraints surrounding the determination of the training equipment design; as such, the model can be completed in stages and updated as warranted by the ISD analyst as the original data base is expanded and analyzed. That is, the ISD analyst may find it useful to complete certain sections of the model as the ISD analysis is in progress. In this way the specification can be updated throughout the ISD analysis cycle. This same degree of freedom and flexibility should be recognized and granted after the specific application of the model is submitted to the procurement officer. That is, the general purpose of the model approach is to communicate to procurement officer the design requirements that are known at the time they are known. The procurement officer and the ISD analyst should be considered cooperative partners in a mission with one goal or purpose - to obtain a maintenance trainer which is both training effective and cost efficient. Both groups should cooperatively work toward this goal and have an understanding that design requirements can, at times, be illusive, difficult to specify, and difficult to document.

8. Some of the requested information (e.g., specification of the characteristics of the target population) is included not as requirements but as useful information to the procurement officer and the contractor. That is, some of the requested information does not necessarily establish design requirements, but provides necessary guidance and background information to the contractor.

Purpose and Use

The model presented here is intended as a means of communication between ISD analysts and the procurement officer. As a means of communication, the model and any specific application of the model must not be considered perfect. The model is designed to decrease the

possible ambiguity, imprecision, and personal interpretation of communicating simulator requirements, to ensure that the correct information is provided and utilized effectively to procure effective devices. The model thus serves the following functions:

1. The model organizes and formats the design requirements in a standardized way. This facilitates communications by assuring that certain design requirements are always located in the same place within the specific application of the model and are stated in approximately the same fashion.

2. A specific application of the model can be used as an interim communication document or as a document that evolves as the ISD analysis is accomplished. Typically, the ISD analysis is started, and as training equipment requirements are identified, they are documented. As the ISD analysis progresses and the data base is expanded, new training equipment requirements are identified and previously identified requirements may be modified. However, at some point, the ISD analyst(s) must submit a final recommendation (typically at the Training Requirements Recommendation Review Meeting - TRRRM). The model specification is designed to be used as a pre-TRRRM communication device, as well as the device for communicating the final recommendations prepared by the ISD analyst. When used as a pre-TRRRM communication device, the ISD analyst can communicate the results of the ISD analysis as they are determined. The resulting document can then be modified and expanded, and previously identified requirements can be further clarified. In a pre-TRRRM document, the specific application of the model can be used to stimulate interaction between the procurement office and the ISD analyst to assure that the communication is being understood by both parties. As the TRRRM approaches, these approximations can be formalized. The formalized or final communication, however, should not be considered perfect. There will most likely be a need for the procurement officer and the ISD analyst to continue clarifying the specified requirements before the procurement officer can prepare the specification that goes to the contractor.

This model for documenting training equipment designs has been developed to ensure that the results of ISD analysis and related training equipment design requirements are clearly communicated according to a standardized format and organization. The anticipated effect of this standardized communication process is that effective, efficient, usable maintenance trainers which support student learning and job performance will be acquired.

SECTION II

ISD-BASED TRAINING EQUIPMENT DESIGN

1.0 SCOPE

1.1 SCOPE, GENERAL

a. This specification establishes the training equipment design requirements for a maintenance trainer. This specification is to be completed by the ISD analyst following an ISD analysis.

b. The following requirements are established in this specification:

(1)	Training Objectives	(Paragraph 2.0)
(2)	Training Application	(Paragraph 3.0)
(3)	Simulation Characteristics	(Paragraph 4.0)
(4)	Instructional Features	(Paragraph 5.0)
(5)	Trainer Configuration	(Paragraph 6.0)

c. Each of these requirements is briefly described in subparagraph 1.3 of this specification.

d. Instructions for completing this specification are provided in the Appendix. The information supplied in this specification by the preparer is subject to the limitations of the data base available to the preparer as well as the time available for conducting the ISD analysis.

1.2 PERFORMANCE ENVIRONMENT TO BE SIMULATED

a. This specification establishes the training equipment design requirements for a maintenance trainer which shall represent _____ system(s)/subsystem(s) of _____.

b. The purpose of the trainer is to provide maintenance training which is directly transferable to the system(s)/subsystem(s) specified in Item a above in the following task areas:

_____

_____

_____

c. A list of all the tasks to be acquired and/or practiced on the trainer is provided in subparagraph 2.4.1 of this specification.

1.3 BRIEF DESCRIPTION OF REQUIREMENTS

Each of the requirements specified in paragraph 1.1 of this specification is briefly described in the subparagraphs below.

1.3.1 TRAINING OBJECTIVES, GENERAL

a. The training objectives which shall be attained by the students using the trainer are specified in paragraph 2.0 and its accompanying subparagraphs in this specification.

b. More specifically paragraph 2.0 and its accompanying subparagraphs provide

(1) The identification of the Air Force Specialty Code (AFSC) that will use the trainer.

(2) A description of the characteristics of the target population.

(3) A list of the task (and part-tasks) that are to be acquired and/or practiced on the maintenance trainer.

(4) A list of the training objectives to be achieved by the target population using the maintenance trainer.

1.3.2 TRAINING APPLICATION, GENERAL

a. A description of how the maintenance trainer shall be used to achieve the training objectives specified in paragraph 2.0 and its accompanying subparagrapns is provided in paragraph 3.0 and its subparagraphs in this specification.

b. More specifically paragraph 3.0 and its accompanying subparagraphs provide

(1) The class of exercises and/or malfunctions to be presented by the intended maintenance trainer.

(2) A description of how the maintenance trainer shall be used by the target population to attain the specified training objectives and to acquire and/or practice the specified tasks (and part-tasks). This description contains the necessary initialization activities, the planned student activities, the planned instructor activities, and a general description of the recording and scoring features.

(3) A description of the learning environment in which the trainer shall be used. This description contains information on the planned utilization of the maintenance trainer, and a list of the support equipment and tools that shall be required to acquire and/or practice the specified tasks and training objectives.

1.3.3 SIMULATION CHARACTERISTICS, GENERAL

a. The physical and functional characteristics of the components represented on the maintenance trainer are specified in paragraph 4.0 and its accompanying subparagraphs in this specification.

b. More specifically, paragraph 4.0 and its accompanying subparagraphs provide

(1) A list of the components that shall be represented on the trainer.

(2) A description of the physical and functional characteristics of components that shall be represented on the trainer. This description provides the level of fidelity that each component being represented shall have.

1.3.4 INSTRUCTIONAL FEATURES, GENERAL

a. The instructional features that the maintenance trainer shall have to assist the student in attaining the specified training objectives and to acquire/practice the specified tasks (and part-tasks) are specified in paragraph 5.0 and its accompanying subparagraphs in this specification.

b. More specifically, paragraph 5.0 and its accompanying subparagraphs provide

(1) A description of the stimulus, response, feedback, and next activity controls which shall be incorporated into the maintenance trainer.

(2) A description of the student station. (Optional.)

(3) A description of the instructor station. (Optional.)

1.3.5 TRAINER CONFIGURATION, GENERAL

The configuration(s) that the trainer shall have is(are) specified in paragraph 6.0 and its accompanying subparagraphs in this specification.

1.4 DEFINITIONS

The terms used herein shall have the meaning specified in this paragraph.

Exercise. An experience to which the student is exposed in order to attain a training objective and/or to acquire and/or practice the performance of a specific task or part-task. An exercise is composed of the presentation of the stimuli, the set responses made by the student, the feedback given to the student concerning the correctness of his response(s), and the determination of the next activity to which the student is to be exposed after making a response or a set of responses. An exercise is to be envisioned as a unit of instruction.

Feedback. Information given to the student concerning the correctness of the response(s) to a particular stimulus. There are two kinds of feedback: feedback which the student receives from the simulated equipment itself (e.g., the reaction of a display as a control is manipulated) and augmented feedback. Augmented feedback is the feedback given to the student by the instructor or by the instructional features built into the trainer. Augmented feedback usually consists of a message that contains a summary of the student's response(s), the correctness of the student's response(s), the consequences of any incorrect response(s), and the reason why a particular response was incorrect.

Fidelity. The degree to which components, parts, Line Replaceable Units (LRUs), Shop Replaceable Units (SRUs), etc. (which are being simulated) are physically and functionally like the actual components, parts, LRUs, SRUs, etc.

Initialization. The activities and functions to be performed by the instructor to make the trainer ready for use by the student.

Instructional Features. Devices or mechanisms on the trainer which control critical aspects of the learning environment, such as presentation of the stimuli, recording and scoring of responses, presentation of augmented feedback messages, and selection of the next activity in which the student is to be engaged. The following are instructional features.

a. On-Off/Select Sensing. A control on the trainer which allows the instructor to turn on or off the devices or mechanisms which sense the student's response(s), or to select only those responses which are to be sensed for a given student exercise. A response that is sensed by the trainer is not necessarily recorded by the trainer.

b. On-Off/Select Recording. A control on the trainer which allows the instructor to turn on or off the devices or mechanisms which record the response(s), or to select only those student responses which are to be recorded for a given exercise. A response that is recorded by the trainer is not necessarily scored by the trainer. All responses recorded by the trainer, however, must be sensed by the trainer.

c. On-Off/Select Scoring. A control on the trainer which allows the instructor to turn on or off the devices or mechanisms which score the recorded responses, or to select only those recorded responses to be scored for a given exercise.

d. On-Off/Select/Reporting. A control on the trainer which allows the instructor to turn on or off the devices or mechanisms which report student response(s) or score(s), or allows the instructor to select those response(s) or score(s) to be reported.

e. On-Off/Select Monitoring. A control on the trainer which allows the instructor to turn on or off the devices or mechanisms which monitor the status of the controls and/or displays of the system or subsystem being simulated, or to select which controls and/or displays are to be monitored for a given exercise. All system displays and/or controls which are monitored by the trainer are sensed, recorded, and reported by the trainer.

f. Reporting Devices. A device used to report student responses and/or scores and/or the status of the system being simulated. Reporting devices are used only if the trainer is reporting responses, scores, or the system status to the instructor. Reporting devices, as used in this specification, are either computer-controlled printers or cathode-ray tube (video) screens.

g. Storage Devices. A device used to store student responses, scores, or the status of the system being simulated for future retrieval (e.g., for diagnostic purposes or for planning future next activities for the student). Storage devices, as used in this specification, are either hardcopy (e.g., printouts which are filed in a convenient manner) or electronic devices (e.g., diskettes, magnetic tape, hard disks).

h. Adjustable Criteria Control. A control on the trainer which allows the instructor to adjust (change or modify) the value to which student responses are compared during scoring. This control is appropriate only if the trainer is automatically scoring student responses.

i. On-Off/Select Feedback Control. A control on the trainer which allows the instructor to turn on or off the devices or mechanisms that provide the student with augmented feedback messages, or to select the time or schedule of the augmented feedback message given to the student during a given exercise.

j. Feedback Message Adjust. A control or device which allows the instructor to adjust (change or modify) the augmented feedback message that is given to the student during a given exercise.

k. Rate Adjust Control. A control on the trainer which allows the instructor to adjust (change or modify) the rate at which stimuli are presented to the student during a given exercise.

l. Signal-to-Noise Adjust. A control on the trainer which allows the instructor to adjust (change or modify) the ratio of signal to noise for a given exercise.

m. Cue Enhancement Control. A control on the trainer which allows the instructor to highlight (magnify, intensify, or otherwise make more noticeable) a stimulus or response for a given exercise. The control can be an on-off control, where all stimuli or responses are highlighted, or a select control, where the instructor can select which stimulus or response is to be highlighted for a given exercise.

n. Malfunction Insertion. A control on the trainer which allows the instructor to select a malfunction which has been programmed into the trainer.

o. Parameter Control. A control on the trainer which allows the instructor to pre-set (before the exercise begins) a parameter value or allows the instructor to input parameter values during the exercise. The control can

be used to make operational a malfunction condition, providing the system parameter being altered signifies a malfunction condition.

p. On-Off/Select Next Activity. A control on the trainer which allows the instructor to turn on or off the next activity pre-programmed for the student, or allows the instructor to select the next activity from a list of pre-programmed next activities.

q. On-Off Freeze. A control on the trainer which allows the instructor to turn on or off the pre-programmed freeze instructions within the trainer or to freeze the trainer in a given state when a freeze is not pre-programmed. A freeze shall cause all displays, controls, indicators, etc. to remain fixed in position at the moment of the freeze.

Line Replaceable Unit (LRU). A part of a system or subsystem with a function of its own and designed to be removed from the system or subsystem without being disassembled. It is the smallest unit to which a malfunction can be isolated by Organization-Level (O-level) maintenance personnel.

Negative Transfer. A condition where previous learning and/or habits of the target population interfere with the learning of new knowledge and/or the performance of new skills.

Part-Task. A segment or only part of a task. It typically does not have a goal or mission of its own and takes on meaning only in light of the entire task.

Pre-programmed. When an instructional feature or capability is labeled pre-programmed, it means that the capability is controlled automatically by the trainer and requires no input from the instructor.

Shop Replaceable Unit (SRU). A part of a subsystem or a part of an LRU, with a function of its own. It is the smallest unit to which a malfunction can be isolated by Intermediate-Level (I-level) maintenance personnel.

Signal-to-Noise Ratio. The proportion of true message (signal) to amount of interference (noise). Think of a telephone message, where the signal is the voice of the speaker and where the noise is the static or interference on the line heard by the listener.

Subsystem. Part of a system, when the system is comprised of two or more parts. A subsystem has a purpose and function of its own

and is designed to interact with its peer subsystems in order to attain the purpose or mission of the system.

System. An assemblage comprised of interrelated and interacting subsystems designed to attain a predetermined purpose; e.g., the flight control system of an aircraft.

Target Population. The population of students who will use the maintenance trainer to attain the specified objectives and/or to acquire and/or practice the specified tasks and part-tasks.

Task. A statement describing the activities a performer must complete to attain a specific goal or mission. The statement at a minimum contains a verb describing the action taken and an object to which the action is addressed.

Trainer. Training equipment which represents the actual equipment with some degree of fidelity. The trainer is used by students to obtain hands-on practice of task performance and to acquire certain training objectives. The term "trainers" as used in this specification can be sophisticated (e.g., computer controlled) or can be two-dimensional representations of the actual equipment (e.g., a mock-up).

Training Objective. A statement describing what is expected of the student at the end of instruction or any time during the instruction. This statement describes the behavior the student is expected to display. If possible, the objective should also contain a description of the conditions under which the expected behavior is to be displayed, providing such conditions are easily identifiable during the ISD analysis. In addition, if possible and to the extent practical, the criteria to which the student's performance will be compared should be identified. However, this definition recognizes the difficulty in establishing both conditions and criteria early in the cycle.

Variable Input or Select Control. When an instructional feature or capability is labeled variable input or as a select control, it means the capability must be entered by the instructor before the capability is automatically controlled by the trainer. For example, a criteria adjust that is variable input requires the instructor to set the value of the criterion before the exercise is started; i.e., the criteria value is not pre-programmed.

1.5 REFERENCES/DOCUMENTS

The following reference/documents were used in the preparation of this ISD-derived training equipment design:

2.0 TRAINING OBJECTIVES

2.1 TRAINING OBJECTIVES, DESCRIPTION

a. This paragraph and the subparagraphs below specify the characteristics of the intended target population and the training objectives to be attained by the student using the intended maintenance trainer.

b. This paragraph and the accompanying subparagraphs provide

(1) The identification of the AFSC(s) that will use the trainer.

(2) A description of the characteristics of the target population.

(3) A list of the tasks (and part-tasks) that are to be acquired and/or practiced on the maintenance trainer.

(4) A list of the training objectives to be achieved by the target population using the maintenance trainer.

2.2 GENERAL INFORMATION

a. The target population(s) to be trained is(are) _____ (AFSC). The specific characteristics of the target population(s) are specified in subparagraph 2.3 herein.

b. After successful completion of the training program, graduates shall have a speciality code of _____ (AFSC) and shall be capable of performing _____-level maintenance.

c. The maintenance trainer shall be used for _____ training.

d. The maintenance trainer shall be used in the following course(s):

e. The courses specified above shall be taught at the following locations:

2.3 TARGET POPULATION CHARACTERISTICS

The intended target population shall have the characteristics specified in the subparagraphs below.

2.3.1 PREVIOUS WEAPON SYSTEM(S) EXPERIENCE

The students using the maintenance trainer to acquire and/or practice the tasks (and part-tasks) specified in subparagraphs 2.4.1 and 2.4.2 of this specification and to achieve the training objectives specified in subparagraph 2.5 herein should have previous experience with the following weapon system(s):

2.3.2 NEGATIVE TRANSFER

Because of the previous weapons sytems(s) experience specified in subparagraph 2.3.1 herein or because of previous training of the target population, it is anticipated that the intended target population should have difficulty in learning the following skills and knowledge and/or tasks:

2.3.3 TARGET POPULATION ASSUMPTIONS (Yes____No___.)

The intended target population(s) described herein should possess the following prerequisite behaviors:

2.4 TASKS AND MALFUNCTIONS

a. The tasks (and part-tasks) to be acquired and/or practiced on the maintenance trainer are listed in subparagraph 2.4.1 of this specification.

b. The classes of malfunctions to be simulated for purposes of isolation and/or correction are specified in subparagraph 2.4.2 below.

2.4.1 TASKS

The tasks and part-tasks to be acquired and/or practiced using the maintenance trainer are listed below:

2.4.2 MALFUNCTIONS

The classes of malfunctions to be simulated on the maintenance trainer for the purpose of isolation and/or correction are listed below:

2. LEARNING OBJECTIVES

The learning objectives to be attained by the target population using the maintenance trainer are listed below:

3.0 TRAINING APPLICATION

3.1 TRAINING APPLICATION, DESCRIPTION

The subparagraphs below describe how the maintenance trainer shall be used by the intended target population(s) to acquire and/or practice the performance of the tasks (and part-tasks) specified in subparagraphs 2.4.1 and 2.4.2 of this specification and to attain the training objectives specified in subparagraph 2.5 herein. The following subparagraphs also describe the characteristics of the learning environment.

3.2 CLASSES OF EXERCISES

The maintenance trainer shall present the following classes of exercises to the intended target population(s):

3.2.1 CLASSES OF EXERCISES, DESCRIPTION

Each of the exercises listed in subparagraph 3.2 above is further described in the subparagraphs which follow.

3.2.1.1 WARM-UP AND INITIALIZATION ACTIVITIES

a. Warm-Up. The maintenance trainer shall be "ready" for initialization within __ minutes after power turn-on.

b. Initialization. Initialization shall include all the functions to be accomplished by the instructor to initialize, verify initialization, and configure the maintenance trainer for training. Initialization activities shall include the following:

_____
_____
_____
_____
_____
_____

c. After warm-up, initialization shall take no longer than _____ minutes.

3.2.1.2 TRAINER, INSTRUCTOR, AND STUDENT ACTIONS

Each of the classes of student exercises specified in subparagraph 3.2 herein is further described in this subparagraph by specifying the activities of the trainer, the instructor, and the student during execution of the exercise:

a. Student Activities.

_____
_____
_____
_____

b. Instructor Activities.

_____
_____
_____
_____

c. Trainer Action and Reaction.

_____
_____
_____
_____

d. Special Features.

_____
_____
_____
_____

3.2.1.3 ADDITION OF EXERCISES/MALFUNCTIONS (Yes __ No __.)

a. The maintenance trainer shall provide a means for adding the following future exercises and/or malfunctions:

_____
_____
_____
_____

b. The addition of future exercises/malfunctions shall be made by

_____
_____
_____
_____

3.3 TRAINING ENVIRONMENT

The subparagraphs to follow describe the conditions in which the maintenance trainer shall be used.

3.3.1 INSTRUCTOR INFORMATION

a. The maintenance trainer shall be designed to be operated by _____ (number) instructors. Operation shall include warm-up, initialization, monitoring, and observing students during any of the exercises specified in subparagraph 3.2 herein.

3.3.2 UTILIZATION

The trainer shall provide efficient training as described in subparagraphs 3.2.1.1 and 3.2.1.2 herein. The trainer will be used in the following situations:

a. A classroom demonstration situation having an instructor-student ratio of _____.

b. A student practice situation involving no more than _____ students.

c. Approximately ____ % of the time spent on the trainer by the student in a practice situation shall be without instructor assistance.

d. Approximately ____ % of the time spent on the trainer by the student in a practice situation shall require instructor assistance.

e. Approximately ____ % of the total instruction time shall be spent by the student on the trainer.

3.3.3 SUPPORT EQUIPMENT, TOOLS, AND JOB MATERIALS

To engage in the exercises specified in subparagraph 3.2 herein, the following support equipment, tools, and job materials shall be used:

_____
_____
_____
_____
_____

3.3.4 OTHER INSTRUCTIONAL EQUIPMENT AND MATERIAL (Yes____No ___.)

The following instructional equipment and materials shall be used by the student while engaged in the exercise specified herein:

_____
_____
_____
_____
_____
_____

4.0 SIMULATION CHARACTERISTICS

4.1 SIMULATION CHARACTERISTICS, DESCRIPTION

The subparagraphs below specify the physical and functional characteristics of the components that shall be represented on the maintenance trainer. The following subparagraphs also specify the aspects of the environment that shall be simulated.

4.2 PICTURES (SKETCHES AND/OR PHOTOGRAPHS) OF THE SYSTEM(S)/SUBSYSTEM(S) BEING SIMULATED (Yes ___ No ___.)

A pictorial representation of the system/subsystem being simulated is provided below: _____.

4.2.1 MAJOR COMPONENT LIST

The maintenance trainer shall be composed of the following major components:

_____
_____
_____
_____
_____

4.2.2 SIMULATED DISPLAYS, CONTROLS, INDICATORS, SRUs, LRUs, AND PARTS

Below is a list of all the displays, controls, indicators, SRUs, LRUs, and parts that shall be simulated and contained on the maintenance trainer:

_____
_____
_____
_____
_____
_____

4.2.3 SIMULATED SUPPORT EQUIPMENT

Following is a list of all support equipment that shall be simulated.

_____
_____
_____
_____
_____

4.3 FIDELITY LEVELS

The maintenance trainer shall represent the system(s)/subsystem(s) specified in subparagraph 1.2a of this specification to the extent necessary to acquire and/or practice the tasks (and part-tasks) specified herein, to identify and/or correct the malfunctions

specified herein, and to attain the training objectives specified in subparagraph 2.5 of this specification. The level of fidelity necessary is further specified below in terms of the characteristics of displays, controls, etc., and the characteristics of the environment.

4.3.1 CHARACTERISTICS OF DISPLAYS AND CONTROLS

a. The displays, controls, indicators, LRUs, SRUs, and parts listed in subparagraph 4.2.2 herein shall have the physical and functional characteristics specified in Table 4.0. (Insert Table 4.0.)

b. The system(s)/subsystem(s) being simulated shall sense the activation of the controls specified herein and provide corresponding output displays and/or reactions as specified herein. The system(s)/subsystem(s) being simulated shall be simulated without the insertion of special lesson procedures unless otherwise stated in this specification.

4.3.1.1 CHARACTERISTICS OF SUPPORT EQUIPMENT AND TOOLS

The support equipment and tools specified in subparagraph 4.2.3 herein shall have the physical and functional characteristics specified below.

_____
_____
_____
_____
_____
_____

4.3.2 ENVIRONMENTAL FIDELITY (Yes____No ___.)

The following aspect of the job performance environment shall be simulated:

_____
_____
_____
_____
_____
_____

4.3.3 PROBABLE ENGINEERING CHANGES (Yes____No___.)

The maintenance trainer shall be designed to accommodate the possible and probable engineering changes specified within this subparagraph:

4.4 OFF-THE-SHELF DISPLAY, CONTROLS, INDICATORS, LRUs, SRUs, AND PARTS

a. Those displays, controls, indicators, LRUs, SRUs, and parts listed in subparagraph 4.2.2 of this specification and described in subparagraph 4.3.1 of this specification which are not identified in this subparagraph as off-the-shelf and/or standard items will be the responsibility of the contractor to furnish.

b. Those displays, controls, indicators, LRUs, SRUs, and parts listed in this subparagraph shall be interfaced with the other displays, controls, indicators, LRUs, SRUs, and parts to the extent necessary for the operational use of the maintenance trainer. The contractor shall have the responsibility of assuring the interface.

c. A list of off-the-shelf or standard items is provided below:

5.0 INSTRUCTIONAL FEATURES

5.1 INSTRUCTIONAL FEATURES, DESCRIPTION

The subparagraphs below specify the instructional capabilities of the maintenance trainer and provide a list of the instructional features/controls which shall be required on the maintenance trainer.

5.2 INSTRUCTIONAL CAPABILITIES

Accomplishment of the training objectives specified in subparagraph 2.5 of this specification requires that the maintenance trainer have several instructional capabilities. The maintenance trainer shall be provided with an instructional system which monitors, controls, evaluates, and provides instructor/student augmented feedback as specified in Table 5.0 and as clarified in the subparagraphs below. (Insert Table 5.0.)

5.2.1 FREEZE CAPABILITY (Yes ___ No ___.)

a. The maintenance trainer shall freeze under the following conditions:

_____
_____
_____
_____
_____
_____

b. The freeze shall cause all displays, controls, indicators, etc. to remain fixed in their position at the moment of the freeze.

c. The freeze shall be activated by:

_____
_____
_____
_____
_____
_____

d. When unfrozen (deactivated), the maintenance trainer shall:

_____
_____
_____
_____
_____
_____

3.2.2 MALFUNCTION SELECTION (Yes ____No ___.)

a. Simulated malfunctions shall be selected in the following manner:

_____
_____
_____
_____

b. Once selected, a malfunction's effects shall remain in effect until:

_____
_____
_____
_____

c. The maintenance trainer shall be designed to permit the creation of future malfunctions specified in subparagraphs 3.2.1.3 of this specification.

3.2.3 SIGN-IN CAPABILITY (Yes ____ No____.)

a. During sign-in, the trainer shall request the following information:

_____
_____
_____

b. Sign-in information entry shall be the responsibility of:

_____
_____
_____

3.2.4 NUMBER OF RESPONSES (Yes ___ No ___.)

There shall be ____ number of responses per student. All responses shall be stored for ____ weeks.

3.2.5 SYSTEM MONITORING (Yes ____No ___.)

a. The following variables and/or responses shall be sensed/recorded by the trainer: _____
_____

b. The following system values shall be monitored by the trainer:

_____
_____

c. The following criteria shalr be pre-programmed and/or entered or adjusted by the instructor: _____

_____

5.2.6 AUGMENTED FEEDBACK CAPABILITY (Yes____No ___.)

a. The following augmented information shall be provided in the feedback message presented by the trainer:

_____

_____

_____

b. The feedback schedule for each objective/exercise shall be as follows:

_____

_____

_____

_____

_____

_____

5.2.7 NEXT ACTIVITY FEATURES (Yes __ No__.)

After an objective/exercise has been completed by the student, the next activity introduced to the student shall be as follows.

_____

_____

_____

_____

_____

_____

5.2.8 STIMULUS PRESENTATION (Yes ___ No ___.)

a. The trainer shall present the stimuli for the objectives/ exercises specified below at the rates specified below:

_____

_____

_____

_____

_____

_____

b. The trainer shall present the stimuli for the objectives/exercises below with the ratio of signal-to-noise specified below.

_____

_____

_____

_____

_____

_____

5.2.9 CUE ENHANCEMENT FEATURES (Yes___ No___.)

The following cues shall be enhanced during the following objectives/exercises:

_____

_____

_____

_____

_____

_____

5.3 STUDENT STATION(S) (Yes ___ No ___.)

5.3.1 STUDENT STATION, NUMBER AND KIND

a. There shall be ____ kinds of student station(s).

b. There shall be ____ of kind one, ____ of kind two.

5.3.2 STUDENT STATION: DISPLAYS, CONTROL, AND INSTRUCTIONAL EQUIPMENT

In addition to the displays, controls, indicators, and parts specified in subparagraph 4.2.2 herein, the student station shall contain the following:

_____

_____

_____

_____

_____

_____

5.4 INSTRUCTOR STATION(S) (Yes ___ No ___.)

5.4.1 INSTRUCTOR STATION(S), NUMBER AND KIND

a. There shall be ____ kinds of instructor stations.

b. There shall be ____ of kind one, ____ of kind two.

5.4.2 INSTRUCTOR STATION(S): DISPLAYS AND CONTROLS

The instructor station shall contain the following displays and controls:

_____
_____
_____
_____
_____
_____

6.0 TRAINER CONFIGURATION

6.1 TRAINER CONFIGURATION, DESCRIPTION

The subparagraphs below specify the configuration of the maintenance trainer.

6.2 STUDENT STATION, INSTRUCTOR STATION RELATIONSHIP (Yes ___ No ___.)

a. External Interface.

_____
_____
_____

b. Internal Interface.

_____
_____
_____
_____

c. Other.

_____
_____
_____

6.3 OTHER CONFIGURATION CONSIDERATIONS (Yes___ No___.)

7.0 NOTES

APPENDIX

MAINTENANCE TRAINING EQUIPMENT: DESIGN SPECIFICATION BASED ON INSTRUCTIONAL SYSTEM DEVELOPMENT RATIONALE AND GUIDANCE, PARAMETERS, AND LESSONS LEARNED

0.0 SCOPE

0.1 SCOPE, GENERAL

This appendix contains the instructions that are necessary to tailor the ISD-Based Training Equipment Design model to a specific application.

0.2 PURPOSE OF MODEL

a. A specific application of the model is prepared by the ISD analyst or the ISD team. The model is designed to communicate to the procurement officer and engineer the training equipment design decisions and requirements that resulted from the ISD analysis.

b. Within the procurement office, the specific application of the model is verified, augmented through appropriate engineering design studies and consultation, and consolidated into a complete procurement specification. The specification prepared by procurement personnel becomes the statement of work for a formal source selection process to identify and contract with the most cost-efficient training equipment manufacturer. The model has been configured to be part of the specification prepared by procurement personnel. This approach minimizes the potential for distortions of the ISD analyst's design and guarantees that the results of the ISD analysis are precisely communicated to the training equipment manufacturing community.

0.3 USE

a. This appendix is designed to assist the ISD analyst/team in tailoring the model for documenting training equipment design to a specific application. The model contains blanks that must be filled and appropriate subparagraphs that might be selected to specify the design requirements of the training equipment. Any subparagraph marked "NO" in the model means the subparagraph and its accompanying subparagraphs are not appropriate.

b. This appendix does not provide a procedure for making the training equipment decisions. The procedures for making the training equipment decisions are documented in Maintenance Training Simulator Design and Acquisition - Handbook of ISD Procedures for Design and Documentation.

c. It is not a requirement to complete the model or a specific application of the model in the order in which the paragraphs and subparagraphs appear in the model; i.e., there is no implied priority in the sequence of the paragraphs contained in the model.

d. The information supplied by the ISD analyst in applying the model must be tempered by the data base available to the ISD analyst and the time available to perform the ISD analysis. Often because of these restrictions the information supplied by the analysts will be incomplete and, thus, not necessarily specific to the level of detail desired. For example, often the lists provided will be only partial lists. However, the ISD analyst should make an attempt to communicate all the decisions and assumptions known at the time of completing this model for a specific application.

e. The instructions provided in this appendix assume the procedures specified in Maintenance Training Simulator Design and Acquisition - Handbook of ISD Procedures for Design and Documentation have been followed. However, it should be recognized that any ISD procedure can be utilized. It should be recalled that the purpose of the model is to communicate to the vendor and procurement officer the functional characteristics of the intended maintenance trainer. The communication of these characteristics is not dependent on the procedures used to derive the characteristics.

0.4 FORMAT

a. The following paragraphs and subparagraphs carry the same numerical designation as the paragraphs and subparagraphs in the model.

b. This appendix contains a rationale for each paragraph and subparagraph in the model. The rationale discusses the purpose the paragraph or subparagraph serves; i.e., the reason why the paragraph or subparagraph appears in the model. Following the rationale is a brief discussion of how the blanks are to be filled; i.e., it suggests wording or concepts for the blanks and describes the sources that might be used in filling the

blanks. Each paragraph or subparagraph contains a section on "Lessons Learned," which reflects any warnings or cautions the ISD analyst/team should observe.

1.0 SCOPE

Rationale and Guidance: This paragraph and accompanying subparagraphs describe the content of the model.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: None.

1.1 SCOPE, GENERAL

Rationale and Guidance: This subparagraph lists the major paragraphs in the model, so that the user can easily locate major paragraphs.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: None.

1.2 PERFORMANCE ENVIRONMENT TO BE SIMULATED

Rationale and Guidance: This subparagraph specifies the system(s)/subsystem(s) to be simulated and specifies the general purpose of the proposed or intended maintenance trainer. This information needs to be clearly communicated to the vendor. The philosophy adopted by the model is to maximize the degree of engineering latitude left to the trainer manufacturer without jeopardizing training effectiveness. Thus, the vendor needs to know this information to design the maintenance trainer.

Parameters: This subparagraph contains two blanks to be completed by the ISD analyst.

a. "This specification establishes the training equipment design requirements for a maintenance trainer which shall represent _____ system(s)/subsystem(s) of _____."

In the first blank, insert the name of the system or subsystem to be simulated; e.g., the flight control system.

In the second blank insert the name of the weapon system; e.g., the F-16 aircraft.

b. "The purpose of the trainer is to provide maintanance training which is directly transferable to the system(s)/subsystem(s) specified in Item a above in the following task areas: _____ _____."

Insert the task areas to be acquired and/or practiced on the intended maintenance trainer. Do not specify all the tasks; specify only the task areas. Tasks are enumerated in subparagraph 2.4.1 of the model. Task areas are the groups of tasks identified and organized in Step 1, Substep 6 of the ISD procedures.

Lessons Learned: Be sure to address all of the general task areas which are pertinent to student learning and practice during training, as well as task areas to be accomplished on the job. The set of task areas listed in this paragraph must be fully representative of job performance requirements as well as training requirements. This should be a list of action verbs that, when paired with system/component names, become task titles.

1.3 BRIEF DESCRIPTION OF REQUIREMENTS

Rationale and Guidance: This subparagraph and the accompanying subparagraphs briefly describe the major paragraphs specified in subparagraph 1.1 of the model.

Parameters: No blanks to be completed by the ISD analyst.

Lassons Learned: The model, although written in a military specification format, does not follow the format of either MIL-T-81821 or MIL-STD-490. As such, the subparagraphs accompanying this subparagraph are needed and facilitate quick and easy location of the specified requirements and design decisions.

1.3.1 TRAINING OBJECTIVES, GENERAL

Rationale and Guidance: This subparagraph briefly describes the contents of paragraph 2.0 of the model. This subparagraph is included to assist the ISD analyst, the procurement officer, and the engineer to locate requirements in the model easily and quickly.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: None.

1.3.2 TRAINING APPLICATION, GENERAL

Rationale and Guidance: This subparagraph briefly describes the contents of paragraph 3.0 of the model. This subparagraph is included to assist the users to locate requirements in the model easily and quickly.

Parameters: No blanks to be completed by ISD analyst.

Lessons Learned: None.

1.3.3 SIMULATION CHARACTERISTICS, GENERAL

Rationale and Guidance: This subparagraph briefly describes the contents of paragraph 4.0 of the model. This subparagraph is included to assist the users to locate requirements in the model easily and quickly.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: None.

1.3.4 INSTRUCTIONAL FEATURES, GENERAL

Rationale and Guidance: This subparagraph briefly describes the contents of paragraph 5.0 of the model. This subparagraph is included to assist the users to locate requirements in the model easily and quickly.

Parameters: No blanks to be completed in ISD analyst.

Lessons Learned: None.

1.3.5 TRAINER CONFIGURATION, GENERAL

Rationale and Guidance: This subparagraph briefly describes the contents of paragraph 6.0 of the model. This subparagraph is included to assist the user to locate requirements in the model easily and quickly.

Parameters: No blanks to be completed by ISD analyst.

Lessons Learned: None.

1.4 DEFINITIONS.

Rationale and Guidance: This subparagraph contains a list of the definitions of the terms used in the model. Many of the terms

used in the model have different meanings to different people; e.g., augmented feedback may have a different meaning for the vendor than for the ISD analyst. This subparagraph would then establish the meanings to be applied.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: If you find it necessary to change the definitions, be sure to change this subparagraph. It is essential that the ISD analyst, procurement officer, engineer, and vendor all use the same set of definitions. A lack of standard definitions will increase the likelihood that training equipment design requirements will be misunderstood.

1.5 REFERENCES/DOCUMENTS

Rationale and Guidance: It will be helpful to the procurement officer and the engineer if a list of reference documents is specified. This will ensure that everyone involved is using the same data basis as the ISD analyst.

Parameters: Insert the title of any references or documents that were used to establish the training equipment design. These might include such things as:

a. Logistical Support Analysis (LSA) documents.

b. Technical Orders (T.O.s).

c. Other Military Specifications or Standards which were used in preparing this specific application.

Lessons Learned: None.

2.0 TRAINING OBJECTIVES

Rationale and Guidance: This paragraph describes the contents of subparagraphs to follow. It is the intent of this paragraph and the accompanying subparagraphs to communicate to the procurement officer, engineer, and vendor the characteristics of the target population and the specific training objectives to be attained.

Parameters: No blanks to be completed by the ISD analyst; however, some of the subparagraphs to follow contain blanks.

Lessons Learned: None.

2.1 TRAINING OBJECTIVES, DESCRIPTION

Rationale and Guidance: This subparagraph lists the specific contents of this section of the model.

Parameters: No blanks to be completed by ISD analyst.

Lessons Learned: None.

2.2 GENERAL INFORMATION

Rationale and Guidance: This subparagraph contains general information which the procurement officer, engineer, and vendor will find useful. It describes the target population and the type of graduates expected from the training programming in which the maintenance trainer will be used.

Parameters: This subparagraph contains five blanks to be completed by the ISD analyst. The ISD analyst should complete only the blanks for which information is available. If the information requested is unknown, then specify "Unknown" or "To be determined."

a. "The target population(s) to be trained is(are) _____ _____ (AFSC)."

Insert the predominate Air Force Specialty Code (AFSC) of the entering students, the target population. If there is more than one predominate AFSC, enter more than one. This information will help the readers to understand the previous training experienced by the target population(s). Such information influences the design of the training equipment and forms the basis of many of the decisions made by the ISD analyst(s); i.e., many of the decisions made can be justified by clearly specifying the AFSC of the target population. The ISD analyst will normally receive this information from the using command.

b. "After successful completion of the training program, graduates shall have a specialty code of _____ (AFSC) and shall be capable of performing _____-level maintenance."

In the first blank enter the AFSC of successful graduates of the training program where the maintenance trainer will be used. If more than one apply, enter more than one. This specialty code indicates to the vendor the type of personnel that will be required to support the operational system in the field and as such, indicates the terminal (end) goals of the training equipment.

In the second blank enter the level of maintenance the graduates will be expected to perform on the operational equipment; I = Intermediate-Level, O = Organization-Level.

c. "The maintenance trainer shall be used for _____ training." Enter "Field," "Resident," and/or "Depot" training, if known. (If not known enter "Unknown.") Such information will influence the design and construction of the maintenance trainer; e.g., it will assist the engineer to determine the durability of the trainer.

If more than one AFSC is specified in Item b above and if more than one type of training is indicated in this blank, then be sure to indicate which type of training applies to which AFSC.

d. "The maintenance trainer shall be used in the following course(s): _____."

Enter the course titles in which the trainer is expected to be used (if known). (If not known, enter "Unknown.") If more than one AFSC was specified in Item b above, beside each course in parentheses enter the AFSC to which the course applies.

e. "The course(s) specified above shall be taught at the following location(s) _____."

Enter the location(s) of the course(s) specified in Item d; i.e., enter facility name, city, state, and country. This information will help the engineeer determine such things as the power supply and source that are available. It will also help the engineer to determine the shipping conditions and the operational environment of the trainer. If information is not known, enter "Unknown."

Lessons Learned: None.

2.3 TARGET POPULATION CHARACTERISTICS

Rationale and Guidance: Characteristics of the target population greatly influence the design of the trainer. It is helpful if the vendor knows as much about the target population as possible.

Subparagraph 2.2, Item a, specifies the predominant AFSC(s) of the target population; often this is not enough information. Frequently the ISD analyst knows more about the target population; this additional information should be recorded in the subparagraphs below. Subparagraph 2.3.1, PREVIOUS WEAPON SYSTEM(S) EXPERIENCE, if known, will assist the vendor in understanding why

certain tasks were selected to be in the training program, while other tasks were not. Subparagraph 2.3.2, NEGATIVE TRANSFER, alerts the vendor to potential learning difficulties that the target population might have; thus, it is anticipatad he will be able to devote special consideration to these areas when he designs the trainer. Subparagraph 2.3.3, TARGET POPULATION ASSUMPTIONS, provides the ISD analyst space to record other known information about the target population which was not appropriate to record or document in the other two subparagraphs.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: This is a new requirement.

2.3.1 PREVIOUS WEAPON SYSTEM(S) EXPERIENCE

Rationale and Guidance: One way to describe the target population is to specify the type of experiences they have been exposed to in the past. If the target population has had experience with weapon systems which are similar to the weapon system(s) under consideration, these weapon systems should be listed in this subparagraph. This information is not intended to be a requirement as much as it is to provide guidance and background to the vendor. This information also clarifies many of the decisions made by the ISD analyst.

Parameters: Enter any previous weapon system(s) which the target population has been exposed to which is(are) similar to the weapons system(s) under consideration. If more than one predominate AFSC has been specified in subparagraph 2.2, Item a, then beside each weapon system listed in this subparagraph indicate, in parentheses, which AFSC has been exposed to that weapon system.

Lessons Learned: None.

2.3.2 NEGATIVE TRANSFER

Rationale and Guidance: Exposure to previous weapon systems can inhibit the learning of new knowledge or the acquisition of new skills. In the new weapon system tasks might be performed slightly differently than performed on the previous weapon system. Thus, exposure to the previous weapon system might interfere with the target population learning the task on the new weapon system. These instances of negative transfer greatly influence the design of the training equipment. That is, the trainer should be designed to minimize or at least account for the problems associated with a negative transfer situation. By specifying these instances of negative transfer, the vendor is better able to design the trainer so that it is optimally effective.

Parameters: Enter the instances of negative transfer. Use FORMs 1 and 2 as your source. Recall that one of the questions asked is "Is negative transfer likely?" For each instance the question is answered "Yes," an entry should be made in this subparagraph. Be sure to describe carefully the occurrence of negative transfer so that the vendor can easily understand the potential training problem. If more than one AFSC has been specified in subparagraph 2.2, Item a, then indicate which AFSC is likely to have the specified negative transfer problem.

Lessons Learned: This is a new requirement.

2.3.3 TARGET POPULATION ASSUMPTIONS

Rationale and Guidance: This is an optional subparagraph. It should be used only if you have made assumptions about the entering behaviors of the target population which have not been specified in subparagraphs 2.3.1 or 2.3.2. If you have not made any assumptions, enter a check beside "NO." If you have made any assumptions, it is reasonable to record these assumptions so that it is clear to everyone what assumptions were made during the ISD analysis.

Parameters: Enter any assumptions made about the behaviors of the target population. These should be entered as skill and knowledge statements; e.g., "the target population can operate test unit XXXZZZ." List only the skills and knowledge which are known and assumed to be outside the normal range of the specified AFSC(s).

Lessons Learned: This is a new requirement.

2.4 TASKS AND MALFUNCTIONS

Rationale and Guidance: This subparagraph and its accompanying subparagraphs provide a means for documenting the tasks that shall be acquired and/or practiced on the maintenance trainer and the malfunctions that are to be isolated and/or corrected using the trainer. This is a header paragraph only.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: None.

2.4.1 TASKS

Rationale and Guidance: This subparagraph requires the ISD analyst to list the tasks (and part-tasks) to be acquired and/or practiced on the intended maintenance trainer. Tasks (and

part-tasks) which are not to be acquired and/or practiced on the maintenance trainer should not be included in this subparagraph.

Parameters: Enter the tasks titles that will be acquired and/or practiced on the trainer. If only part of a task is to be acquired and/or practiced using the trainer, specify the entire task and clearly indicate the part(s) which is(are) to be acquired and/or practiced on the trainer. For convenience, you may elect to present the information in table form.

TASK NO.	TASK TITLE	T.O. REF	AFSC	COURSE

For each task or part-task, whether reported in table form or not, specify the task number (same as on FORM 1), task title (same as on FORM 1), Technical Order (T.O.) reference (same as on FORM 1), the AFSC that will be required to acquire and/or practice the task (required if more than one AFSC was specified in subparagraph 2.2., Item a), and the course title the task will be taught in (required only if more than one course is specified in subparagraph 2.2, Item d). The tasks should be listed in hierarchical fashion, starting with function, then procedure. Tasks should be properly grouped within the hierarchy. Tasks and part-tasks to be practiced and/or acquired on the maintenance trainer are determined following the procedures in the Handbook of ISD Procedures. Do not provide a complete Logistics Support Analysis (LSA) or task description - this information will not be useful at this time. However, you may consider providing such descriptions or LSA to the vendor or contractor upon award of the contract.

NOTE: Be sure to list the T.O.s referenced in this subparagraph in subparagraph 1.5.

Lessons Learned: Completion of this subparagraph does not require a listing of the steps/activities involved in each task; thus, it is important to phrase the task title clearly and to provide the number of the task, so that easy reference can be made to a FORM 1 or an LSA. It may be useful to list tasks by categories (e.g., operation/checkout, remove/replace, troubleshooting) to make understanding of the intended use of the simulator clear and straightforward for the specification developer. Special attention and care must be taken to be accurate in listing tasks which will make up the majority of simulator use. (For example, if troubleshooting tasks are 80 percent of all tasks to be simulated, special attention should be given to the troubleshooting task listings.)

2.4.2 MALFUNCTIONS

Rationale and Guidance: It is necessary for the vendor to know what types (classes) of malfunctions are to be simulated by the maintenance trainer. This subparagraph is not requesting each specific malfunction, only classes of malfunctions; e.g., you need specify only the "isolation of fuses" and not the isolation of specific fuses such as "isolation of fuse 36 X D1," providing that all the fuses are basically the same. If the fuses are different, they should be listed as a separate malfunction class. The list provided should be a representative sample of the possible malfunctions.

The list you provide should be organized in a systematic fashion; e.g., malfunctions which are to be isolated to a certain subsystem should be listed before those malfunctions which can be isolated to a given LRU or SRU within that subsystem. Thus, in presenting the list, you may find it convenient to nest malfunctions within malfunctions.

When generating the list of malfunctions from the ISD analysis, be careful to specify to the malfunction is only to be isolated by the target population or to be isolated and corrected. If the malfunction is to be corrected by physical manipulation (e.g., actually replacing a defective fuse) then this must be considered in the design of the maintenance trainer. If the malfunction once isolated is only corrected by the student pressing a button (e.g., indicating or signaling the removal and replacement of the fuse), then the design of the trainer would be different.

It should also be apparent that malfunction isolation can take on many forms. For example, isolating malfunctions following detailed T.O.s is different than isolating a malfunction which is not proceduralized in a T.O. The latter type of isolation behavior requires knowledge of the logic of the system and perhaps even knowledge of the software driving the system. Thus, when listing the malfunctions, you must make it clear what type of isolation behavior is required.

Parameters: Enter a list of malfunctions. The classes of malfunctions listed should be derived using the procedures in Maintenance Simulator Design and Acquisition - Handbook of ISD Procedures and Documentation.

For ease of presentation, the information requested may be presented in table form.

MALFUNCTION DESCRIPTION	ISOLATION		CORRECTION		AFSC	COURSE
	T.O.	NO T.O.	R&R	SIGNAL		

For each malfunction, whether reported in table form or not, specify if the malfunction is to be isolated (if yes, indicate if adequate T.O. exists), if the malfunction is to be corrected (if yes, indicate if physical removal and replacement are required or if removal and replacement can be just signaled by the student), the AFSC that will be required to isolate and/or correct the malfunction, and the course title in which the malfunction will be presented. The latter two items are required only if the trainer is being designed for more than one AFSC and if the trainer will be used in more than one course.

Lessons Learned: Specifying the malfunctions to be simulated is one of the most critical tasks in preparing and communicating the training equipment design. Experience has indicated that trainers frequently are manufactured with inadequate malfunction isolation and/or correction capabilities. Often in the past the malfunctions to be simulated by the trainer have been determined by the vendor, based on the likelihood and frequency of the malfunction in the operational equipment. As the operational equipment is in service longer, new malfunctions often emerge, malfunctions which were not originally anticipated and designed into the training equipment. This severely limits the utility of the maintenance trainer. The model recognizes that it is difficult to "see" into the future; however, this problem is somewhat minimized by completing subparagraph 3.2.1.3. Other problems or complaints have centered around the nature of the malfunctions specified by the vendor. In the past there has been an attempt to specify the number of malfunctions the maintenance trainer should simulate (i.e., the number of malfunctions the vendor should build into the trainer). This has often resulted in the vendor selecting malfunctions which are basically the same, or are considered trivial, just to meet the number requirement. It is essential that the list of malfunctions in this subparagraph clearly communicates that a representative sample of malfunctions has been selected, and that trivial or inapplicable malfunctions are not included. Representativeness and comprehensiveness of the malfunctions included are to be considered somewhat more important than the absolute number of malfunctions to be presented on the trainer. This will help to ensure that the trainer can be kept current with changing prime item system characteristics.

2.5 LEARNING OBJECTIVES

Rationale and Guidance: To design a maintenance trainer properly it is essential for the vendor to know what learning objectives are going to be achieved using the trainer. When specifying the objectives, be sure to describe:

- the behavior expected of the student.
- the condition under which the behavior is expected (if known).
- the criteria of successful performance (if known).

Parameters: Enter the training objectives using FORM 4 and FORM 2 of the ISD Procedural Handbook as a source. FORM 2 should provide the behavior as well as any conditions, whereas FORM 4 provides information concerning possible criteria. For ease of presentation consider presenting the objectives in table form.

BEHAVIOR	CONDITION	CRITERIA	AFSC	COURSE

If more than one AFSC will be using the trainer, be sure to specify what objectives are to be attained by what AFSC. If the trainer will be used in more than one course, be sure to specify in what course the specific objective will be presented.

Lessons Learned: None.

3.0 TRAINING APPLICATION

Rationale and Guidance: The subparagraphs to this paragraph describe how the maintenance trainer will be used to accomplish the specified objectives. The intended use of the trainer influences the design of the trainer. This paragraph is only a header paragraph.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: None.

3.1 TRAINING APPLICATION, DESCRIPTION

Rationale and Guidance: This subparagraph describes the content of the subparagraphs to follow.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: None.

3.2 CLASSES OF EXERCISES

Rationale and Guidance: The purpose of this subparagraph is to communicate to the vendor the types of exercises that the maintenance trainer shall present to the student. This subparagraph requests only a list of the classes of exercises. The exercises listed in this subparagraph are further described in subparagraphs 3.2.1, 3.2.1.1, and 3.2.1.2.

Parameter: Enter the list of exercises to be presented to the student via the maintenance trainer. The preliminary utilization plan developed during the ISD process should serve as the primary source for the contents of this subparagraph. You need not enter specific exercises but only classes of exercises. Classes of exercises are defined as a group of training objectives, tasks to be acquired and/or practiced, and/or malfunctions to be isolated and/or corrected. For ease of presentation consider presenting this information in table form.

EXERCISE	OBJECTIVES, TASKS AND MALFUNCTIONS	AFSC	COURSE
(enter title)	(enter task #, objective #, and malfunction #)	(use only if more than one AFSC)	(use only if more than one course)

Lessons Learned: Maintenance tasks can be categorized into three types: operational checks, remove/replace, and troubleshooting. Of the three, troubleshooting is the predominant task taught in most maintenance training simulators. For the simulators studied in a recent survey, an average of 50 percent of student task time

was spent on troubleshooting.[5] The type of task to be trained will affect the decision to use simulator training, as well as the design of the trainer.

3.2.1 CLASSES OF EXERCISES, DESCRIPTION

Rationale and Guidance: This is only a header subparagraph indicating that the next three subparagraphs describe the exercises listed in subparagraph 3.2.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: None.

3.2.1.1 WARM-UP AND INITIALIZATION ACTIVITIES

Rationale and Guidance: This subparagraph assumes that the warm-up and initialization activities will be the same across all exercises. The information requested in this subparagraph is the length of time of warm-up, a list of the initialization activities, and the length of time of the initialization activities. This information is included in the model only to provide guidance to the vendor.

Parameters: There are three blanks to be completed by the ISD analyst.

a. "Warm-Up. The maintenance trainer shall be 'ready' for initialization within _____ minutes after power turn-on.

Enter the maximum amount of time desired for warm-up in minutes. When determining warm-up time, consider the following factors:

- the time available between class sessions (the end of one class and the beginning of the next class).
- the time available between exercises within a given class session (if the trainer is to be powered down between exercises).
- operating environmental condition (a colder environment will require a longer warm-up).

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[5]Carroll, R. J., Thocher, L. T., Roth, J. T., & Massey, R. H. Maintenance training simulators: Their use, cost, and perceived effectiveness. Valencia, PA: Applied Science Associates, Inc., 1984.

A review of maintenance trainer specifications indicates that the usual time allotted for warm-up in a normal classroom environment is approximately 15 minutes.

b. "Initialization. Initialization shall include all the functions to be accomplished by the instructor to initalize, verify initialization and configure the maintenance trainer for training. Initialization activities shall include the following: _____
_____."

Enter the desired initialization activities. The following activities should be considered.

- Loading the operational (application) program for the exercise being presented to the student.
- Verifying the loading of the operational (application) program.
- Selecting a given exercise from a menu (pre-programmed).
- Selecting a given malfunction from a menu (pre-programmed).
- Setting parameters (electronically or mechanically) to create a malfunction condition not pre-programmed.
- Activating the interfaces between components (e.g., turn-on of printer).
- Selecting and setting applicable instructional features.
- Receiving a set of directions indicating the value of displays during initialization.
- Loading 35mm slide projector.
- Loading and running a diagnostic program.

Often the selection of initialization activities is left to the vendor or contractor; you should enter only those activities which you want and desire. If you are going to leave the selection of the initialization activities to the vendor or contractor, delete the last sentence in item b and substitute "The contractor shall determine the initialization activities."

c. "After warm-up, initialization shall take no longer than _____ minutes."

Insert maximum number of minutes for instructor to complete the initialization activities. Consider the same factors as in Item a, above, plus the time devoted to warm-up. Note that warm-up time plus initialization time equals the number of minutes it will take to have the trainer ready for training.

Lessons Learned: Generally, the larger the internal computer memory, the longer it takes for the computer to conduct parity checks/self-diagnostics which contribute to the warm-up time.

3.2.1.2 TRAINER, INSTRUCTOR, AND STUDENT ACTIVITIES

Rationale and Guidance: Subparagraph 3.2 specified the classes of exercises to be presented to the student. This subparagraph describes each of these exercises in more detail. For each exercise specified describe the activities of the students, the activities of the instructor, the actions and reactions of trainer to student actions, and any special features the trainer must have. If all the exercises are to be run in the same manner, only one scenario needs to be entered.

This information will help the vendor visualize how the trainer will be used. These descriptions should be as brief as possible, but should clearly communicate to the vendor how the intended trainer is to be used.

Parameters: There are four blanks to be completed by the ISD analyst for each class of exercise specified in subparagraph 3.2.

a. "Student Activities"

Enter the activities that the student will be engaged in during the given exercise. Consider the following:

- Location of T.O.s.
- Use of T.O.s, if exercise is primarily procedural. Use of job aids and test equipment.
- Need for remedial instruction if student performs poorly.

Consider the following paragraph as an example.

"(1) When presented with the exercise, the trainer will inform the student of the objective that must be achieved.

(2) The student will locate the appropriate T.O.

(3) The student will follow the procedures in the T.O., using the necessary support equipment.

(4) For additional information (e.g., the specific location of a component or visual of the actual component), the student will request a specific slide by pressing a button next to the component; the slide will then appear.

(5) After completion of the exercise, the student will receive augmented feedback information on his/her performance."

b. "Instructor Activities"

Enter the activities of the instructor during the given exercise. Consider the following:

- Observation of the student.
- Augmented feedback obligations.
- Monitoring the system (status of displays and controls).
- Freeze the system, if a fatal error occurs, etc.

Do not include initialization activities since they are presented in subparagraph 3.2.1.1.

c. "Trainer Action and Reaction"

Enter any actions or reactions of the trainer during the given exercise. For example, "when the student sets the XYZ control, movement of the leading edge flaps will be shown on a display in degrees".

d. "Special Features"

Enter any special features that the trainer must have for the given exercise. Consider the following:

- Monitoring capabilities.
- Ability to set rate of stimulus presentation.

- Ability to highlight cues.
- Ability to freeze automatically (or on demand).
- Ability to select next activity after completion of the exercise.
- Ability to print a report of student's performance.

NOTE: Specific instructional features are also discussed in paragraph 5.0.

It is not necessary to separate in the text you provide, student activities, instructor activities, trainer actions, and special features; i.e., the narrative you provide must only discuss these issues, but the discussion can be organized in any manner you deem appropriate. Recall that the purpose of this subparagraph is to provide information to the vendor concerning how you see the intended trainer being used.

Lessons Learned: The design requirement specified here usually appears in paragraph 3.1 of the specification prepared by the procurement officer (SIMULATOR DESCRIPTION). In the past, the approach has been to generalize across all exercises presented to the student. This approach is new since it involves specifying requirements for each class of practical exercise, if the scenario is different for each exercise or student problem.

3.2.1.3 ADDITION OF EXERCISES/MALFUNCTIONS

Rationale and Guidance: The purpose of this subparagraph is to help the engineer determine the future growth requirements of the trainer. This is a "Yes" or "No" subparagraph. If you can anticipate the need to have the trainer present more exercises/malfunctions in the future, check "Yes"; otherwise, check "No."

It is often difficult and expensive to add new exercises/-malfunctions to the trainer once the trainer has been designed and fabricated. Often the Air Force is locked into a given vendor for the addition of new exercises or malfunctions. To avoid this problem, the trainer should be initially designed to permit the Air Force to add new exercises/malfunctions easily and relatively inexpensively. This can be accomplished only if the ISD analyst can foresee the type of exercise/malfunctions which might be needed in the future. Thus, part of the cost of future additions can be absorbed into the initial design.

Parameters: There are two blanks which need to be completed by the ISD analyst.

a. "The maintenance trainer shall provide a means for adding the following future exercises and/or malfunctions: _____."

   Enter a list of future exercises and/or malfunctions (if known).

b. "The addition of future exercises/malfunctions shall be made by _____."

   Enter the type of personnel (e.g., qualified Air Force personnel, instructor, etc.). Provide as much information as possible. Also, you might want to provide a brief description of how the future malfunctions might be created; e.g., "All future malfunctions will be created by the instructor, setting system parameter values from a terminal or keyboard."

Lessons Learned: Many recent maintenance training simulators (post-1981) have the capacity for malfunction insertion via computer generation or pretaped cassettes. The computer-generated fault capability often allows for an unlimited number of faults. This capability allows for future addition of malfunctions, helping to make the maintenance simulator cost-effective. Malfunction insertion/update was almost unanimously favored by maintenance training instructors in a survey of maintenance training simulator use. However, in most cases, programming skills were required in order to add new malfunctions.[6]

3.3 TRAINING ENVIRONMENT

Rationale and Guidance: This is a header subparagraph which explains the purpose of the subparagraphs to follow. The purpose of the subparagraphs to follow is to define the training environment in which the trainer will be used. This information will assist the vendor in designing and constructing the trainer.

Parameters: No blank to be completed by the ISD analyst.

Lessons Learned: None.

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[6]Carroll, R. J., Thocher, L. T., Roth, J. T., & Massey, R. H. Maintenance training simulators: Their use, cost, and perceived effectiveness. Valencia, PA: Applied Science Associates, Inc., 1984.

3.3.1 INSTRUCTOR INFORMATION

Rationale and Guidance: The purpose of this subparagraph is to inform the vendor how many instructors will be required to conduct the exercises and to operate the trainer during a typical classroom session.

Parameters:

a. "The maintenance trainer shall be designed to be operated by _____ instructors."

Enter the minimum number of instructors who will be required to operate the trainer during any one session. Specify the worst possible case.

Lessons Learned: The number of instructors depends on trainer type, student flow, system configuration, and other variables. A trade-off analysis to determine the optimum number of instructors should be conducted.

3.3.2 UTILIZATION

Rationale and Guidance: Typically, trainers are used in two ways; by the instructor to demonstrate a procedure and by the student to practice and/or acquire specific skills. This subparagraph requests the instructor-to-student ratio in both of these situations, as well as the percent of student time spent on the trainer in practice with and without instructor assistance.

Parameters: There are five blanks to be completed by the ISD analyst.

a. "A classroom demonstration situation having an instructor-to-student ratio of _____."

Enter the instructor-to-student ratio expected in the demonstation situation; e.g., 1 to 10 or 2 to 20. The first number entered should be consistent with subparagraph 3.3.1, Item a. If the maintenance trainer is not going to be used in a demonstration situation, enter "Not Applicable." You should specify the worst possible case.

b. "A practice situation involving no more than ____ students."

Enter the number of students who will be using the trainer during any given exercise (practice situation); e.g., 2. Again you should specify the worst possible case.

c. "Approximately ____ % of the time spent on the trainer by the student in a practice situation will be without instructor assistance."

Enter the percent of time spent on the trainer by the student in a practice situation which will require instructor assistance (other than initialization). The intent here is to specify the amount of time the student will be practicing on his/her own without instructor assistance. If the percent of time requested is unknown, enter "Unknown."

d. "Approximately ____ % of the time spent on the trainer by the student in a practice situation will require instructor assistance."

Enter the percent of time spent on the trainer by the student which will require instructor assistance (e.g., requires the instructor to observe the student, give guidance to the student, etc.). If the percent of time requested is unknown, enter "Unknown."

e. "Approximately ____ % of the total instruction time will be spent by the student on the trainer.

Enter the percent of the total instruction time that the student will spend on the trainer. If unknown, enter "Unknown." Notice that items c and d above make sense only in terms of item e.

Lessons Learned: Many recently built maintenance trainers are designed such that instruction can be self-paced. There are psychological benefits to this feature as well as time/cost benefits. Research has shown that students tend to enjoy the learning/training process more when they can go at their own pace, and when they are the only ones who see their mistakes. Students who learn at an above average rate of speed can proceed at a faster rate through the instructional sequence, thus shortening the course and saving money. Of course, the material to be trained and other constraints will determine the appropriateness of a self-paced approach.

3.3.3 SUPPORT EQUIPMENT, TOOLS, AND JOB MATERIALS

Rationale and Guidance: The design of the trainer is influenced by the support equipment, tools, and job materials the student uses during the exercises specified in subparagraph 3.2. For example, the trainer might have to interface with support equipment (e.g., test equipment). In addition, the use of job materials might permit the trainer to be less sophisticated than if the job materials were not permitted; i.e., less instructional features might be built into the trainer when job aids are permitted.

Parameters: List all the support equipment, tools, and job materials that the student will be permitted to use during the exercises. Do not specify standard tools and do not specify T.O.s (since T.O.s are specified in subparagraph 2.4.1). For ease of presentation consider presenting this information in table form.

EXERCISE	SUPPORT EQUIPMENT, TOOLS, JOB MATERIALS

Lessons Learned: It may be useful to provide a reference (e.g., published document number) with each tool or piece of support equipment listed. This would tell the vendor whether the tool has been identified by a published doucment or a subject matter expert.

3.3.4 OTHER INSTRUCTIONAL EQUIPMENT AND MATERIALS

Rationale and Guidance: The purpose of this subparagraph is to specify the instructional equipment that must interface with the trainer during the exercises specified in subparagraph 3.2.

Parameters: Enter a list of the instructional equipment and materials that must interface with the trainer; e.g., slide projector, video tape machine, video disc machines, etc. Do not include media or instructional equipment which are not going to interface with the trainer. If possible, specify any special requirements of the instructional equipment; e.g., random access slide projector, with access less than 0.05 seconds.

Lessons Learned: Use and specification of commercially available or off-the-shelf hardware, when possible, will tend to decrease simulator cost and development effort.

4.0 SIMULATION CHARACTERISTICS

Rationale and Guidance: This is a header paragraph.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: None.

4.1 SIMULATION CHARACTERISTICS, DESCRIPTION

Rationale and Guidance: This subparagraph describes the content of the subparagraphs within this major paragraph.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: None.

4.2 PICTURES (SKETCHES AND/OR PHOTOGRAPHS) OF SIMULATED SYSTEM(S)/SUBSYSTEM(S)

Rationale and Guidance: The purpose of this subparagraph is to provide the vendor with an idea of what actual components look like. These are to be pictures or sketches of the actual equipment being represented by the trainer. These are not to be pictures or sketches of what the representation should look like. There should be a sketch and/or photograph of each component that is to be represented (e.g., each panel). The sketches can be hand drawn and should show all the necessary displays and controls. Also, if necessary, sketches of the inside of the component should be provided if internal components are to be represented on the trainer. Be sure all drawings are properly labeled. Also label each control/display, indicator, etc. illustrated on the sketches/drawings.

Parameters: Insert sketches or pictures of the actual components (SRUs, LRUs, parts, etc.) which are to be represented on the trainer.

Lessons Learned: None.

4.2.1 SIMULATED COMPONENT LIST

Rationale and Guidance: This subparagraph should contain a list of the major components to be simulated (e.g., panels and drawers). List only the major components; do not list the display controls, indicators, etc. located on the major components. The display, controls, indicators, etc. are requested in another subparagraph.

Parameters: Enter list of major components. This list should be coordinated with the pictures and/or sketches provided in subparagraph 4.2. Use FORM 3a as your source document when compiling this list. The contents of this subparagraph, subparagraph 4.2.2 and subparagraph 4.3.1 can be combined into one subparagraph. If this is done, then subparagraphs 4.2.2 and 4.3.1 can be deleted.

Lessons Learned: None.

4.2.2 SIMULATED DISPLAYS, CONTROLS, INDICATORS, SRUs, LRUs, AND PARTS

Rationale and Guidance: For each major component listed in subparagraph 4.2.1, list all the displays, controls, indicators,

etc. that are to be simulated. For convenience, you may combine subparagraph 4.2.1 and this subparagraph. If the subparagraphs are combined, the provided list should be hierarchically presented; i.e., the major component should be listed first and an indented list of the displays, controls, and indicators should follow each major component.

Parameters: Enter list of displays, controls, and indicators to be simulated. Use FORM 3a as the primary source document.

Lessons Learned: None.

4.2.3 SIMULATED SUPPORT EQUIPMENT

Rationale and Guidance: The purpose of this subparagraph is to provide a list of all the support equipment which is to be simulated; e.g., test equipment. For each piece of support equipment to be simulated, also list the displays, controls, and indicators on that support equipment which are to be simulated.

The contents of this subparagraph can be combined with the content of subparagraph 4.3.1.1; if the two subparagraphs are combined into one subparagraph, subparagraph 4.3.1.1 can be deleted.

Parameters: Enter list of support equipment to be simulated. Also enter list of displays, controls, indicators, etc. on the support equipment that are to be simulated. Use FORM 3a as your primary source. Also recall that all support equipment, tools, and job materials are listed in subparagraph 3.3.4.

Lessons Learned: None.

4.3 FIDELITY LEVELS

Rationale and Guidance: This subparagraph explains that the trainer must simulate the displays and controls of the actual equipment to the degree necessary for the students to practice and/or acquire the tasks specified, to identify and/or correct the malfunctions specified, and to achieve the objectives specified. This subparagraph also points out that there are two aspects of the job situation which can be simulated: the equipment itself (operational equipment) and the job environment. A more detailed discussion of fidelity can be found in the AFHRL report Maintenance Training Simulators: Their Use, Cost, and Perceived Effectiveness.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: None.

4.3.1 CHARACTERISTICS OF DISPLAYS AND CONTROLS

Rationale and Guidance: The purpose of this subparagraph is to describe the physical and functional characteristics of each of the items being simulated. When describing the physical characteristics, include a description of such aspects as

- Shape.
- Color.
- Size.
- Texture.
- Weight.
- Center of gravity.

These physical features are identified from the procedures provided in the Handbook of ISD Procedures for Design and Documentation. Recall that these features should be described only when they serve as stimuli to the student, provide a response mechanism for the student or provide feedback to the student.

When describing the functional characteristics, include such things as

- Interaction with other displays/controls.
- Reaction time.
- Degree of resistance to movement.
- Control/display ratio.
- Direction and range of response.

These functional features are also identified from the procedures provided in the Maintenance Training Simulator Design and Acquisition - Handbook of ISD Procedures for Design and Documentation.

Parameters: Enter the physical and functional characteristics of the items being simulated. Everything listed in subparagraphs 4.2.1 and 4.2.2 should be described in: this subparagraph. For convenience, include FORM 3a, providing FORM 3a is correctly completed and contains an adequate description of characteristics of the components.

Lessons Learned: This is one of the most critical parts of the training equipment design. This subparagraph must fully describe how the simulated equipment is to look and behave. If the descriptions provided are inadequate or incomplete, it is highly unlikely that the training equipment, when fabricated, will function as desired. Inadequate descriptions will result in the fabrication of a trainer that cannot be used to achieve the training objectives specified herein.

4.3.1.1 CHARACTERISTICS OF SUPPORT EQUIPMENT AND TOOLS

Rationale and Guidance: The purpose of this subparagraph is to describe the physical and functional characteristics of the support equipment and tools that are to be simulated; i.e., those listed in subparagraph 4.2.3. The support equipment and tools should be described in the same manner as the displays and controls (see subparagraph 4.3.1 of this Appendix).

Parameters: Enter descriptions of the simulated support equipment and tools. FORM 3a and the procedures used to construct FORM 3a can be used to identify the stimulus, response, and feedback characteristics of the support equipment and tools.

Lessons Learned: It is critical, when describing the support equipment and tools, to describe the interface that is required between the simulated equipment and the simulated support equipment. NOTE: Interface is also discussed in subparagraph 6.2 of the model.

4.3.2 ENVIRONMENTAL FIDELITY

Rationale and Guidance: The purpose of this subparagraph is to provide information concerning the aspects of the job environment that need to be simulated. This subparagraph should contain a description of the job environment that needs to be simulated, such as the ambient noise levels and/or air conditions critical to the job (e.g., a noise level of 94 dBA, a temperature of 0°C). If teams are involved, you should also consider specifying the location of the students relative to each other.

Parameters: Enter any environmental conditions that need to be simulated. Use FORM 3a, FORM 4, and any other information that specifies the conditions of student performance. Specify any student-to-student communication requirements if the trainer is being used by two or more students as a team.

Lessons Learned: Great care must be taken in choosing the kind of environmental fidelity features to be included in a trainer. Adding environmental fidelity increases the cost of the simulator, but will not always increase training effectiveness to the same degree that costs increase when these features are included. Be sure that the costs of adding environmental fidelity are carefully considered against the training benefits that may result.

4.3.3 PROBABLE ENGINEERING CHANGES

Rationale and Guidance: Since maintenance trainers are designed early in the weapon systems acquisition cycle, many engineering changes in the actual equipment can be expected. If these engineering changes can be predicted, then it might be possible to

design the trainer in such a way as to accommodate these changes easily. For example, if the location of a display or control is expected to change, then this information might allow the vendor to consider designing the display or control such that it can easily be relocated or at least easily removed. Functional changes may be more difficult to predict. At any rate, any information concerning probable engineering changes of the equipment being simulated would be helpful to the vendor.

Parameters: Enter any engineering changes that experience indicates might occur. Also discuss the implication of the predicted engineering change; for example, location of displays and controls, addition of new displays and controls, new functions of displays and controls, new control/display ratios, etc. If a new location is expected, try to anticipate where the new location might be.

Lessons Learned: This is a new requirement.

4.4 OFF-THE-SHELF DISPLAYS, CONTROLS, INDICATORS, LRUs, SRUs, AND PARTS

Rationale and Guidance: Items a and b in this subparagraph are explanatory in nature and require no input or modification by the ISD analyst. The other subparagraphs in this section refer to the equipment and/or displays and controls that are to be simulated. This subparagraph describes those displays, controls, indicators, LRUs, SRUs, and parts that can be off-the-shelf and as such do not need to be simulated or modified. Such a list is contained in the specification to assure that the vendor knows that the specified off-the-shelf equipment must be included and interfaced with the controls, displays, etc. that are to be simulated.

Parameters: Enter list of off-the-shelf equipment to be included or used on the trainer. FORM 3a can be used as a source. If any part, SRU, LRU, etc. indicated on FORM 3a must appear exactly as the actual equipment and function as the actual equipment, consider using an off-the-shelf item. Any item listed in subparagraph 4.2.2 must not appear in this subparagraph.

Lessons Learned: The procedures specified in the ISD Handbook provide a means for indicating the degree of fidelity required of each simulated item. In most cases, only certain aspects of the equipment item are critical to learning, and the entire item need not necessarily be physically or functionally identical to the actual equipment. This depends on the overall kind of trainer being designed and on the learning demands of the tasks to be trained. There are times when the actual equipment item is required, or when it is more economical to use an actual equipment item. When actual equipment must be used, the parts of this subparagraph are reversed. Costs of using off-the-shelf items

should also be considered. Trainer design features often make it difficult and expensive to interface off-the-shelf items with the trainer.

5.0 INSTRUCTIONAL FEATURES

Rationale and Guidance: This is only a header paragraph used to identify the Instructional Features section of the model.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: None.

5.1 INSTRUCTIONAL FEATURES, DESCRIPTION

Rationale and Guidance:: This subparagraph explains the contents of the subparagraphs within the major paragraph.

Parameters: No blanks to be completed by the ISD analyst.

Lessons Learned: None.

5.2 INSTRUCTIONAL CAPABILITIES

Rationale and Guidance: This subparagraph contains the instructional features and/or capabilities the trainer must have to facilitate attainment of the specified objectives. It should be pointed out that each objective might require a different set of instructional capabilities; i.e., instructional features and/or capabilites are training objective specific. Thus, it is important to identify which objectives require which capabilities. Identification and determination are made following the procedures in the Handbook of ISD Procedures for Design and Documentation.

Instructional features are those features on the trainer which control certain aspects of the learning environment; the presentation of the stimulus, the monitoring of student responses, the provision of augmented feedback to the student concerning the correctness of that response, and the selection of the next activity to which the student is directed. The Handbook of ISD Procedures for Design and Documentation makes a determination of 17 possible instructional features. Those instructional features that are required are to be listed in this subparagraph and are further clarified in the subparagraphs which follow.

Parameters: Enter the instructional features required to complete each specific training objective or insert FORM 4 and the Instructional Feature Worksheet (as Table 5.0 and Table 5.1, respectively).

Lessons Learned: Instructional features are a new area and not much has been learned about their specifications.

5.2.1 FREEZE CAPABILITY.

Rationale and Guidance: If a freeze capability is indicated, it needs to be further described in this section. If no freeze capability is required, enter a check beside "No" in the space provided.

In this subparagraph describe

- When the trainer shall freeze.
- How the freeze shall be deactivated.
- What the trainer shall do when the controls/displays are unfrozen.

This information can be recorded on FORM 4 (Table 5.0 of the model) instead of in a separate subparagraph.

Parameters: There are three blanks to be completed by the ISD analyst.

a. "The maintenance trainer shall freeze under the following conditions: _____."

Enter the conditions that must exist to cause the trainer to freeze. These conditions might be different for each training objective; if this is the case, associate each condition with a particular objective. Possible conditions are

- On the _____ procedural error (e.g., "the trainer shall freeze when the third procedural error is committed by the student").
- When a dangerous situation is created by the student's actions; dangerous is defined as a situation which might cause harm to the student or harm to the equipment.
- On demand of the instructor (i.e., the freeze is not pre-programmed).

b. No entry to be made by the ISD analyst.

c. "The freeze shall be deactivated by _____."

Enter how the freeze shall be deactivated. Possible activation strategies are

- A control located on the instructor station.

- By the correction of the error(s) that caused the freeze. (If this method is selected, provisions must be made for identifying which errors must be corrected; e.g., "errors to be corrected are displayed on the CRT at the time of the freeze.")

d. "When unfrozen (deactivated) the maintenance trainer shall _____."

Enter what occurs after deactivation of the freeze. Possible options are:

- To have the problem or exercise start from the beginning.
- To have the problem or exercise continue as if the error was not committed and the freeze did not occur.
- To have the trainer backup to the error (first error) and have the student continue from there.

Also consider the possibility of displaying the errors on a CRT or a printer, along with the correction procedure. If possible, communicate to the student why the error was critical.

Lessons Learned: Not much information has been gathered about the freeze feature.

5.2.2 MALFUNCTION SELECTION

Rationale and Guidance: This subparagraph shall be included only if malfunctions are to be identified and/or corrected by the students. If malfunctions are not to be identified and/or corrected, place a check beside "No" in the space provided.

Parameters: There are two blanks to be completed by the ISD analyst.

a. "Simulated malfunctions shall be selected in the following manner: _____."

Enter how the malfunctions for a particular exercise are to be selected. Malfunctions can be selected in three different ways:

- By having the instructor activate certain switches or mechanical devices or by having the instructor insert defective LRUs, SRUs, parts, or components.

- By having the instructor insert special parameter values which would create a given malfunction (insertion of values must be made via a keyboard).

- Pre-programmed (if the trainer is computer driven). In this case a malfunction menu can appear on a CRT and be selected by the instructor either by using a light/sonic pencil or by entering a menu number on a keyboard.

FORM 4 specifies if the malfunction is to be pre-programmed or if parameter values are to be set. If not all malfunctions are to be selected/created the same way, then specify how each is to be selected or created. Consider specifying this in table form.

MALFUNCTION	SELECTION METHOD

If the selection method is through a parameter set control, specify which parameters and values need to be set to select/create the specific malfunctions; i.e., specify the parameter and the value that parameter must have to create a specific malfunction.

b. "Once selected, a malfunction's effect shall remain in effect until _____."

Enter when a malfunction's effect is cancelled. Usually one of two methods is used:

- A malfunction's effect is cancelled when the student performs the proper corrective action or has correctly identified the correct malfunction.

- A malfunction's effect can be cancelled by the instructor using a control on the instructor station. Activation of the control returns the equipment to a normal state.

Lessons Learned: The largest number of instructional features is not always the best. Depending on the specific maintenance training simulator, a number of malfunctions may be available but not practical for the specific training purposes in question.

5.2.3 SIGN-IN CAPABILITY

Rationale and Guidance: This subparagraph should be completed only if a sign-in is required (i.e., indicated on FORM 4). If a sign-in is required, then the vendor will need to know what information is to be requested during the sign-in activities.

Parameters: Enter the information the trainer should request during the sign-in activity. Consider the following:

- Student's name (or team name).
- Student's ID number (or team ID number).
- Exercise number or designation.
- Training objective number.
- Level of training (AFSC).
- Level of cue enhancement.

Also indicate who shall have responsibility for providing the sign-in information (the student or the instructor).

Lessons Learned: None.

5.2.4 NUMBER OF RESPONSES

Rationale and Guidance: This subparagraph should be completed only if a storage device is required. If a storage device is required, some estimate of the capacity of the storage device needs to be given. This is difficult to determine, but it would be helpful in determining the capacity of the storage device if the engineer knew how many responses per student need to be stored, as well as the length of time they need to be stored.

Parameters: Enter the number of responses (per student) which must be stored and enter how long the responses must be stored (in weeks). This information will help the procurement officer to determine the capacity of the needed storage device.

Lessons Learned: This is a new requirement.

5.2.5 SYSTEM MONITORING

Rationale and Guidance: Each training objective/exercise presented by the trainer requires that certain student responses be sensed, recorded, scored, and/or reported. It is essential to communicate to the vendor what responses and variables are sensed, recorded, scored, and reported by the trainer. It is also important for the vendor to know what system parameters are to be monitored.

Parameters: There are three blanks to be completed by the ISD analyst.

a. "The following variables and/or responses shall be sensed/recorded/scored/reported by the trainer _____."

Enter the variables or responses the trainer must keep track of for each objective. The information can be presented in table form.

OBJECTIVE NUMBER	VARIABLE	DEGREE			
		SENSED	RECORDED	SCORED	REPORTED

This information can be obtained directly from the Instructional Features Worksheet. List only those variables/responses for which the trainer has responsibility (i.e., has a "T" entered in the appropriate columns of the Instructional Features Worksheet). Enter only the highest responsibility of those sensed, recorded, scored, or reported (these terms are defined in the ISD Handbook).

b. "The following system values s all be monitored by the trainer _____."

Enter the system values to be monitored per objective or exercise (e.g., the reading on display XYZ). Include only those objective/exercises where the trainer has the responsibility to monitor the simulated system. This information can be presented in table form.

OBJECTIVE NUMBER	SYSTEM VALUE

This information can be obtained directly from the Instructional Features Worksheet.

c. "The following criteria shall be pre-programmed and/or entered or adjusted by the instructor: _____."

For each objective/exercise enter the criteria against which the student's performance will be compared. Enter only the criteria for those objectives/exercises where the trainer will have responsibility for scoring the student's performance. Do not include those objectives/exercises where the instructor is given the responsibility for scoring the student's performance. This information can be presented in table form.

OBJECTIVE NUMBER	CRITERIA VALUE	PRE-PROGRAMMED	VARIABLE INPUT/OUTPUT

If an objective requires adjustable criteria (variable input criteria), specify the possible range of criteria values.

This information is directly obtainable from the Instructional Features Worksheet.

Lessons Learned: This is a new requirement.

5.2.6 AUGMENTED FEEDBACK CAPABILITY

Rationale and Guidance: This subparagraph should be completed only if feedback is being controlled by the trainer. If this is the case, place a check beside "Yes" in the space provided.

Two aspects of augmented feedback need to be clarified: the content of the augmented feedback message, and the feedback schedule. Since augmented feedback is objective/exercise specific, the content of the message and the schedule must be specified for each objective/exercise.

Parameters: There are two blanks to be completed by the ISD analyst.

a. "The following information shall be provided in the augmented feedback message presented by the trainer: _____."

Enter the content of the augmented feedback message presented by the trainer. If part of the message is provided by the instructor, indicate which part. Also indicate if the instructor needs the capability to adjust the augmented feedback message. This information is directly obtainable from the Instructional Features Worksheet and FORM 4. The required information can be presented in table form.

OBJECTIVE NUMBER	CONTENT			ADJUST CAPABILITY	PRE-PROGRAMMED
	INCORRECT RESPONSE	SCORE	REASON		

b. "The feedback schedule for each objective/exarcise shall be the following: _____."

Enter the feedback schedule for each objective/exercise where augmented feedback is controlled by the trainer. The feedback schedule can be either immediate or delayed. Also specify if the schedule is to be pre-programmed or set by the instructor before the objective/exercise begins. This information is obtainable from the Instructional Features Worksheet and FORM 4 and can be presented in table form.

OBJECTIVE NUMBER	SCHEDULE		PRE-PROGRAMMED	ADJUSTABLE
	IMMEDIATE	DELAYED		

Lessons Learned: This is a new requirement.

5.2.7 NEXT ACTIVITY FEATURES

Rationale and Guidance: This subparagraph should be completed only if the next activity is controlled by the trainer. If the next activity is controlled by the trainer for any objective/exercise, place a check beside the "Yes" in the space provided.

If the next activity is controlled by the trainer, then the vendor will need to know what the next activity is to be. In addition, the vendor will need to know if the instructor wants the capability to alter the next activity if it is pre-programmed or to select the next activity from a menu of possible next activities.

Parameters: For each objective/exercise, enter the next activity to be introduced to the student. Also indicate if the next activity is pre-programmed and if the instructor wants the capability to change that next activity to another activity. If there is more than one possible next activity, then allow the instructor to select the next activity from a menu. This information is obtainable from the Instructional Features Worksheet and FORM 4. This information can be presented in table form.

OBJECTIVE NUMBER	NEXT ACTIVITY (ACTIVITIES)	PRE-PROGRAMMED		MENU
		NO CHANGE	FUTURE CHANGE	

Lessons Learned: Often the next activity can be controlled by the simulator and the instructor, allowing for greater flexibility in the design of the maintenance course. Additional research needs to be conducted to determine the training and cost effectiveness of next-activity controls.

5.2.8 STIMULUS PRESENTATION

Rationale and Guidance: This subparagraph should be completed only if the trainer is controlling the rate of stimulus presentation and/or the ratio of signal to noise. If the trainer is controlling these aspects of the learning environment, place a check beside "Yes" in the space provided.

If the trainer is controlling the rate of stimulus presentation, the vendor must be informed of the rate(s) at which the stimulus is to be presented. The rate(s) may vary from: objective/-exercise to objective/exercise; thus, they must be specified for each objective/exercise.

If the trainer is controlling the signal-to-noise ratio, then the vendor must be informed of the desired ratio(s) for each objective/exercise.

Parameters:

a. "The trainer shall present the stimuli for the specified objective/exercises at the rates specified below: _____."

For each objective where the trainer has control over the rate, enter the rate of stimulus presentation; e.g., two stimuli/minute. If the rate is to be entered by the instructor, instead of pre-programmed, indicate the possible range of rates. This information can be presented in table form.

OBJECTIVE NUMBER	PRE-PROGRAMMED RATE	VARIABLE RATE RANGE

b. "The trainer shall present the stimulus for each objective/exercise below with the ratio of signal to noise specified below: _____."

Enter the ratio of signal to noise for each objective/exercise where the trainer has control of the ratio of signal to noise. This can be entered as a specific ratio if known (e.g., 10-to-1) or as an intensity (e.g., high signal to low noise). Also specify if the ratio is pre-programmed or if it is to be entered by the instructor before the objective/exercise is presented to the student. This information can be presented in table form.

OBJECTIVE NUMBER	PRE-PROGRAMMED RATIO(S)	VARIABLE RATIO RANGE

Lessons Learned: This is a new requirement.

5.2.9 CUE ENHANCEMENT FEATURES

Rationale and Guidance: This subparagraph should be completed only if cue enhancement is going to be provided by the trainer; if it is, place a check beside the "Yes" in the space provided.

If cue enhancement is going to be provided by the trainer, the vendor must know which objectives/exercises require cue enhancement, as well as what cues are to be enhanced.

Parameters: Enter a list of the objectives that require cue enhancement and enter the cues which are to be enhanced. Also specify if the enhancement of a particular cue is pre-programmed or to be entered by the instructor. This information can be presented in table form.

OBJECTIVE NUMBER	CUE TO BE ENHANCED	PRE-PROGRAMMED	VALIDATE INPUT

Lessons Learned: This is a new requirement.

5.3 STUDENT STATION(S)

Rationale and Guidance: This subparagraph should be completed only if there is going to be a student station. Most trainers have a student station and an instructor station. However, there is a trend to combine the student station and instructor station into one station, from which both the instructor and student conduct and participate in the training. It is not the intent of this paragraph to force a particular configuration on the ISD analyst. If the analyst decides to have only one station, then paragraph 5.3 should be relabeled "STATION(S)" and subparagraph 5.3.1, subparagraph 5.3.2, paragraph 5.4, subparagraph 5.4.1, and subparagraph 5.4.2 should be deleted. The relabeled paragraph 5.3 should then describe how the station is to look by listing the controls that are to be located on that station.

Parameters: No blanks to be completed by ISD analyst.

Lessons Learned: None.

5.3.1 STUDENT STATION(S), NUMBER AND KIND

Rationale and Guidance: The purpose of this subparagraph is to inform the vendor of the different kinds of student stations that are required, as well as the number of each kind that is required.

Most maintanance trainers have only one type or kind of student station. However, there may be instances when more than one kind is required; e.g., when teams are required to complete a given task each team member might have a different kind of student station.

Parameters: There are two blanks to be completed by the ISD analyst:

a. "There shall be _____ kind(s) of student station(s)."

   Enter the number of kinds or types of student station(s).

b. "There shall be ___ of kind one, ____ of kind two."

   Enter the number of each kind; if more than two, continue the sentence; e.g., "___ of kind three," etc.

Lessons Learned: The number and kinds of student stations are a function of the general type of trainer, the expected student throughput, the number and kinds of tasks to be trained, the cost of student stations, and many other variables. Deciding on the exact number and kinds of student stations is a complex tradeoff between these variables. You must make these tradeoffs depending on the factors of your particular situation and requirements for training. In general, it is good practice to keep the number of different kinds of student stations to a minimum, as well as the total number of scudent stations. This must be traded off with the total requirements for student throughput, however.

5.3.2 STUDENT STATION: DISPLAYS, CONTROLS, AND INSTRUCTIONAL EQUIPMENT

Rationale and Guidance: The purpose of this subparagraph is to list the displays, controls, etc. located on the student station. If only one kind of student station is indicated in subparagraph 5.3.1, there is no need to list the same controls and displays specified in subparagraph 4.2.2. However, if more than one type or kind of student station is indicated, you must list the displays and controls that are to be on each individually.

If only one type or kind of student station is indicated, then list only the instructional equipment that is to be part of the student station.

Parameters: Enter displays, controls, etc. located on each kind of student station. Also entar any instructional equipment located on the student station. Consider the following instructional equipment:

- Slide projector (specify if random access is required).
- Instructional communication system: (e.g., student-to-student or instructor-to-student. A communication system will be needed if there is a high noise level generated by the trainer).
- CRT (cathode-ray tube) to receive instruction or to receive augmented feedback.
- Keyboard (to enter responses).
- Video playback unit (video disk or tape).

Lessons Learned: None.

5.4 INSTRUCTOR STATION(S)

Rationale and Guidance: This paragraph should be completed only if there is going to be an instructor station.

Parameters: None; header paragraph only.

Lessons Learned: None.

5.4.1 INSTRUCTOR STATION(S), NUMBER AND KIND

Rationale and Guidance: The purpose of this subparagraph is to communicate to the vendor the number and kind of instructor stations required. Usually only one kinds of instructor station is required.

Parameters: There are two blanks to be completed by the ISD analyst.

a. "There shall be ____ kind(s) of instructor station(s)"

Enter the number of kinds of instructor stations.

b. "There shall be ___ of kind one, ____ of kind two."

Enter the number of each kind required; if more than two, continue the sentence; i.e., "____ of kind three," etc.

Lessons Learned: None.

5.4.2 INSTRUCTOR STATION(S), DISPLAYS AND CONTROLS

Rationale and Guidance: The purpose of this subparagraph is to communicate to the vendor the displays and controls to be located on the instructor station(s). If more than one instructor station is specified in subparagraph 5.4.1a, then separately list the displays and controls of each kind.

Parameters: Enter the displays and controls to be located on the instructor station. Possible items on the instructor station are:

Printer (specify speed and type; e.g., 30 characters per second, impact printer).

CRT (cathode-ray tube).

Keyboard.

Computer/Processor.

Slave displays and controls (displays and controls which appear on the student station).

Instructional feature controls (for a list of possible controls see subparagraph 1.4, Definitions).

Lessons Learned: None.

6.0 TRAINER CONFIGURATION

Rationale and Guidance: This is a header paragraph used only to permit the user to locate the trainer configuration section of the Training Equipment Design Requirements (TEDR) specification.

Parameters: None.

Lessons Learned: None.

6.1 TRAINER CONFIGURATION, DESCRIPTION

Rationale and Guidance: The purpose of this subparagraph is to specify the content of the subparagraphs within this major paragraph heading.

Parameters: None.

Lessons Learned: None.

6.2 STUDENT STATION, INSTRUCTOR STATION RELATIONSHIPS

Rationale and Guidance: The purpose of this subparagraph is to specify the external and internal interfaces that are required to interconnect the various stations with each other and/or the facility. This subparagraph should be completed only if such interfaces are known; i.e., if you have a certain configuration in mind. There is also an "Other" category which should be used to specify unique relationships between the various components on the trainer.

Parameters: There are three blanks to be completed.

a. "External Interface _____."

b. "Internal Interface _____."

When specifying the interfaces, consider the following:

- Power interface with facility (just specify if needed, not type).
- Hydraulic interface with facility (just specify if needed, not type).
- Interface between instructor station and student station (if known; e.g., interface between possible computer and student station).
- Interface between student station and instructional equipment such as a slide projector.
- Interface with test equipment and other support equipment or tools.
- Mechanical interface with facility.
- Computer equipment interface (e.g., interface with printer, CRT, storage device).

c. "Other _____."

Enter any other component relationships; e.g., the need to have the student station be visible from the instructor station so students can be observed; the need to have a barrier between two student stations; the need to have the instructor station out of student view so ancillary cues are not easily detected by the student.

Lessons Learned: Once the training equipment is designed, any interfaces affecting the facility must be communicated to the facility manager so that he can assure that such interfaces are ready when the training equipment is ready.

6.3 OTHER CONFIGURATION CONSIDERATIONS

Rationale and Guidance: This subparagraph is reserved for any other information concerning the configuration of the trainer which the ISD analyst wants to communicate to the vendor or Acquisition Manager. This subparagraph should be completed only if the ISD analyst can derive any environmental restriction from the specified design.

- Physical size and dimensions.
- Suggested drawings of the maintenance trainer indicating specific design or configuration requirements.

Parameters: Enter any other configuration information you want to communicate to the vendor or contractor and to the facility manager.

Lessons Learned: If suggested drawings are included, it should be made clear that the drawings provided are only suggestions to the vendor and as such do not represent a requirement or a set of requirements.